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ABSTRACT

The Vocabulary Development Project (VDP) was a pilot study designed to demonstrate that significant improvement in language skills is possible with a sustained, massive program of vocabulary exercises. The subjects were inner-city fourth, fifth, and sixth graders. As this project was not a full-blown experimental study, a control group-experimental group paradigm was not used. Tests used were the Gates-MacGinitie (reading comprehension and vocabulary) Test, Iowa Tests of Basic Skills (spelling) and the Lorge-Thorndike IQ Test. Ninety "Pre-tests", ninety "Re-tests" and ten "Mastery tests" developed for the VDP teaching packages also yielded data for each child. Analysis of data showed considerable gains in achievement; the average gain in IQ measures was some four or five points. Samples of VDP tests, and graphs of VDP and standardized achievement test results for sex, IQ, grade, and race analyses are appended. [Part of the Vocabulary Mastery Test in Appendix A will not be clear in hard copy reproduction.] (KG)

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# ST. LOUIS' VOCABULARY DEVELOPMENT PROJECT

A Report On The
1968-69 Demonstration

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# INTRODUCTION

Vocabulary becomes a serious obstacle to many children's learning about the time they reach the fourth grade. During the primary years, most teaching materials use a very limited vocabulary--several thousand of the most frequently used words at most, and there is little word meaning problem. In their primary reading instruction, the children learn to recognize whole-word patterns or to associate letters and sounds. By those methods they can identify words that are already in their hearing and speaking vocabularies. The problem arises when students leave the controlled vocabularies of the basal texts and begin encountering words that are new to them in their science, arithmetic, and social studies text books. They often have little skill in deciphering meanings of words from the context and little appetite for using the dictionary. Inner-city children, especially, often come from backgrounds that have not exposed them to the kinds of words that schools rely on for teaching. The St. Louis Vocabulary Development Project is designed to confront the vocabulary problem during the stage in school when students are first being challenged by the expanded vocabularies of subject matter texts.

The assumption behind the Vocabulary Development Project has been that a systematic, massive infusion of new words over extended time at the middle grade level will produce marked gains in children's verbal achievement as measured by standardized tests. The intention has been to improve vocabulary and, thus, to improve both reading and general school learning ability.

The Vocabulary Development Project started in 1967 with the development and testing of vocabulary materials. The source of words for the vocabulary units was Thorndike and Lorge's The Teacher's Word Book (1945) which lists 30,000 words according to their frequency of use in English prose. Out of the first (or most frequently used) thousand words were chosen words which would be likely to give some fourth graders difficulty. Those words were arranged alphabetically in groups of twenty and simple multiple choice vocabulary tests were devised. The same was done with the second thousand, the third, the fourth, and so on. The lists were printed as Pre-tests of twenty words, Re-tests of the same twenty words in scrambled order, and Mastery tests of 100 words. The units were separated into sets--A, B, C, etc.--and packed into boxes. Thus, nineteen boxes of the tests arranged in order of frequency of use were produced. (See samples in Appendix A.)

The program received its formal testing during a seven-month period of the 1968-69 school year. A fourth, fifth, and sixth grade class from one school in each of the six decentralized St. Louis school districts--a total of eighteen classes--were chosen. The children were given the Lorge-Thorndike Intelligence Test, the Gates-MacGinitie Reading Test, and the spelling part of the Iowa Tests of Basic Skills. All groups started with Pre-test I, Level A. The Pre-test was followed by a vocabulary teaching program by radio. During the program the twenty Pre-test words were pronounced while the classroom teacher wrote the spellings and pronunciations on the board. Each word was defined and discussed in the radio program. There were four radio programs per week.

In the radio programs, the words for the day and words from previous lessons were used in recounting Greek and Roman myths. (See sample in Appendix B.) Mimeographed copies of the myths, with the test words underlined, were sent to the eighteen classrooms so that the children could follow along as the stories were being read. Classical myths were used because of their universal interest and because many urban children have had no exposure to that part of their heritage. Teachers were asked to find additional ways of using the words to increase the children's familiarity with them.

After the radio program, the teacher gave the Re-test, and before the close of the day, he gave the next Pre-test in preparation for the next program. After a set of nine lessons had been completed, the children were given a Mastery test of 100 words randomly chosen from the 180 words presented in the set. Classroom teachers involved in the program did not have to grade the tests or compile records. The answers were marked on machine-scored Digitek answer sheets which were tabulated at the Division of Data Processing. The school system's computer provided data by child, by class in each school, and by overall grade level. At the end of 91 programs, involving 1800 words, other forms of the same intelligence test, spelling test, and the vocabulary and silent reading tests were given.

The 1968-69 demonstration project produced desirable results. In the 1969-70 school year, after some modification, the program became a part of the instruction for all middle grade students in the city.

## RESULTS AND DISCUSSION OF 1968-69 DEMONSTRATION

The Vocabulary Development pilot project was designed to demonstrate that significant improvement in language skills is possible with a sustained, massive program of vocabulary exercises. The project was not conceived as a tight experiment which would permit rejection of null hypotheses after the application of refined statistical methods. We simply wanted to know whether we could significantly improve students' facility with word meaning and whether this improved skill would generalize to other areas such as silent reading comprehension, spelling, and paper and pencil IQ performance.

Since the project was not intended as a full-blown experimental study, a control group-experimental group paradigm was not used. Pre- and Post-test data on two standardized achievement tests, the Gates-MacGinitie (reading comprehension and vocabulary) and the Iowa Tests of Basic Skills (spelling) were collected, however. Pre- and Post-test Lorge-Thorndike IQ scores were also collected from each student. "Pre-test," "Re-test," and "Mastery test" scores from the Vocabulary Development Project teaching package were also assembled for each child in the program. Data from 90 Pre-tests, 90 Re-tests, and 10 Mastery tests were available for each pupil.

A simple Pre-test and Post-test analysis was not sufficient for evaluation of the project. The children might have made the gains anyway, at least on the achievement tests. A measure was needed that would allow each child's performance to be measured against his own previous performance. That measure would offer more stability than simple pre- and post performance: we would be able to see more clearly the effect of the project year in comparison with previous years' performance. The metric finally decided upon was learning rate, defined as Achievement Test score (in grade equivalent) divided by the number of years spent in school + 1. For instance, a child in the first month of his fourth year in school who scored a 4.1 on one of the tests would have a learning rate of 4.1/4.1 = 1.00 or 100 percent. A learning rate of 100 percent means that the child is making normal or expected progress--he is progressing one month in achievement for each month spent in school. In seven months, the child with a learning rate of 100 percent would be expected to gain seven months on an achievement test. Similarly, a child with a learning rate of 70 percent would be expected to make only five months gain in seven school months, while a child with a learning rate of 130 percent would be expected to make nine months gain in a seven-month period of time. The seven-month period of time used in this example is not completely accidental; seven months was the time span of the Vocabulary Development Project. For each child, we calculated a "pre" learning rate,

which is a cumulative index of prior rate of achievement. We also computed a "post" learning rate which was an index of the rate of achievement for the project period only. Post learning rates were derived by dividing the difference between Pre- and Post-test achievement test scores by seven months, the duration of the project. In other words, we felt that the average child should show an achievement test difference of seven months in seven months, or a learning rate of 100 percent. We, thus, had a means of comparing prior rate of achievement with achievement shown during the project period without resorting to the use of a control group: each child served as his own control.

Using the prior learning rate, it was a relatively simple operation to compute expected Post-test achievement test scores for each child. A comparison of Expected Gain with Actual Gain over the period of the project was thus possible.

## DATA ANALYSIS

With this enormous mass of data on hand, we quite clearly needed a means of reducing the data to manageable proportions without masking important trends and interactions. Averages were used throughout the analyses for essentially two reasons: (a) the data did not warrant more powerful statistical manipulations, and (b) the mean is a familiar descriptive statistic. Measures of variability about the mean, which were also computed, suggested that the trends and absolute magnitudes of the data are not to be interpreted literally; in other words, small differences may have resulted from the operation of chance factors only. Cautious interpretation of effects is necessary.

Data from 90 Pre-tests, 90 Re-tests, and 10 Mastery tests obtained from the Vocabulary Development Project teaching package for each child were too much to analyze for individual children. We, therefore, decided to plot the Pre-test/Re-test data for each classroom. These data are not reported in this paper but served instead as feedback to those responsible for the content of the teaching package. For example, there was marked variability from one test to the next (within the same set) which reflected a need for revision of some of the material. The variability among classrooms, even at the same grade level, suggested the need for active participation by the classroom teacher in the day-to-day conduct of the radio program.

We still needed a way of reducing the Pre-test/Re-test/Mastery test data to proportions which would not cloud important effects. It was, therefore, decided to take the average of all 90 tests for each child. Similar averages were computed for Re-tests and the Mastery tests. Although day-to-day variation is lost by combining the data in this way, differences among Pre-test, Re-test, and

Mastery test data are unambiguous. We found average performance to be a useful description of how well the children did on the Pre-tests, Re-tests, and Mastery tests.

For purposes of comparison, we divided the group who had both Pre-test and Post-test data on the basis of four variables: sex, grade, race, and Pre-test Lorge-Thorndike IQ. The median Pre-test IQ turned out to be 97, and children were assigned either to the High IQ group (97 or greater) or the Low IQ group (96 or less). In addition to forming the comparison groups on the basis of these four primary variables, all possible combinations of the four variables taken two at a time were made. Thus, we had a Grade x Sex grouping, a Sex x IQ grouping, and so forth. Altogether, the data were split in ten different ways in an attempt to clarify the effects of the Vocabulary Development Project on the performance of certain sub-groups of the children. In the Sex x IQ grouping, for example, four sub-groups were compared: Low IQ boys, Low IQ girls, High IQ boys, and High IQ girls.

Not only could the performance of each sub-group be assessed, but interactions among the sub-groups as well. To continue the present example, Low IQ boys could have made greater absolute gains than Low IQ girls, but the opposite may have happened within the High IQ group: High IQ girls may have made greater gains than High IQ boys.* Answers to these and similar questions are relatively easy to obtain because of the way the sub-groups were formed for comparison.

The double combinations described above seemed an appropriate place to halt the analyses. The number of students in each sub-group was adequate to yield a reliable estimate of the average performance of the sub-group. Combinations of the four primary variables taken three at a time (e.g., Sex x Grade x IQ) would have yielded sample sizes too small for valid comparison. Besides, the possibility of an "analytical overkill" was obvious. Similarly, the four-way combination of Sex x Grade x Race x IQ was not computed (an average of 17 pupils in each of 24 sub-groups is simply not large enough to draw anything but the flimsiest of conclusions).

Tables 1-10 (Appendix C) contain information relating to the standardized achievement tests. The "expected" Post-test score was based upon the prior learning rate. A student with a prior learning rate of 100 percent would be expected to gain seven months on the achievement test in the seven months of the project.

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*Actual results, to be reported later, indicated large IQ differences, but minor sex differences and essentially no interaction.

Figures 1-20 (Appendix D) contain information concerning performance on the Vocabulary Development Project Pre-test, Re-test, and Mastery test data, Lorge-Thorndike IQ scores, and pre- and post learning rates for each of the three subject matter areas tested. Two figures are presented for each of the ten combinations of the four primary variables (Appendix D).

It should be noted that the data reported in these tables and figures represent various measurements on only those pupils who were available for both Pre- and Post-testing. The total number of children whose data were used in the various analyses was 408. Of these 408 children, only 75 percent (n = 300) had data which would allow us to compute learning rates. A separate analysis revealed that test results of those children for whom the data were available did not differ significantly from those children for whom we lacked this information with one major exception: white children who had spent their entire school career in the St. Louis public school system scored markedly higher on achievement tests than white children who had not spent their whole school career here. This difference was not related to IQ, grade, or sex differences, nor did this difference hold for black students.

Learning rates were computed on children with these data but were also applied to children (in the same grouping) who lacked these data. The careful reader may note occasional discrepancies between prior learning rate and "expected Post-test score" in some of the analyses, but these discrepancies appear to be distributed in an essentially random manner. In any event, the differences are trivial. (See the single exception noted above).

For each of the ten combinations of the four basic variables, a brief interpretation of the numerical data was written. The reader may wish to form his own conclusions based on the statistical data, but he should keep in mind two essential points: (a) variability in the data do not warrant strict, literal interpretations, and (b) this project was conceived as a demonstration. We collected data, performed some rudimentary analyses, and are reporting the data as they stand. With these qualifications in mind, here are our interpretations of the data:

SEX DIFFERENCES

Vocabulary Development Project (VDP): Boys and girls made similar scores on Pre-test, Re-test, and Mastery tests, though girls made slightly higher scores. Both boys and girls made very similar gains. (Figure 1., Appendix D, p.43.)

Standardized Achievement Tests (SAT): Boys had slightly higher Pre-test scores in vocabulary and comprehension, while girls had higher Pre-test scores in spelling. However, both boys

and girls made approximately the same gains in all three areas. Actual gains exceeded expected gains by one to three months (Table 1, Appendix C, p.30).

Lorge-Thorndike IQ: Boys and girls made similar gains on the Lorge-Thorndike IQ test after beginning at about the same level. Average gains were about four-five points (Figure 1.).

Learning Rate (LR): In all three areas tested, both boys and girls began with learning rates below 100 percent and ended with learning rates above 100 percent (Figure 2., Appendix D, p.45).

Conclusions: The Vocabulary Development Project did not affect boys and girls differentially. There were no consistent differences between the two sexes on any of the measures except on performance on the Re-tests and Mastery tests of the Vocabulary Development Project.

IQ DIFFERENCES

VDP: High IQ students made higher scores on Pre-test, Re-test, and Mastery test than Low IQ students. It is interesting to note, however, that both groups of students had higher Mastery test scores than Pre-test scores. This latter point would seem to indicate that the students retained a significant amount of what they were taught via the radio programs (Figure 3).

SAT: In all three areas tested, High IQ students made greater absolute gains than did their Low IQ counterparts (Table 2, Appendix C, p.31).

IQ: Low IQ students gained an average of 5.4 IQ points from Pre- to Post-test; High IQ students gained only 3.1 points on the average (Figure 3., Appendix D, p.47).

LR: Low IQ students showed greater differences between pre- and post learning rates than did High IQ students. These differences were especially apparent in the areas of vocabulary and spelling. Both groups made similar gains in LR on the reading comprehension test (Figure 4., Appendix D, p.49).

Conclusions: Both High and Low IQ groups apparently benefited from the Vocabulary Development Project. Actual gains exceeded expected gains by one--three months on the average. The Vocabulary Development Project did not differentially affect the two groups but rather increased each group's absolute level of performance by about the same amount.

GRADE DIFFERENCES

VDP: Sixth graders made higher scores than fifth graders who in turn made higher scores than fourth graders on Pre-test, Re-test, and Mastery test; however, each of the three grades

made approximately the same absolute gains from Pre-test to Re-test and from Re-test to Mastery. Fourth grade children fell somewhat more from Re-test to Mastery test, indicating a possible lower level of retention (Figure 5).

SAT: Students from the three grades not only began at different levels but had different rates of gain. In general, sixth graders showed greater absolute gains than fifth graders, who in turn showed greater gains than fourth graders. Actual gains exceeded expected gains by one--three months. The only reversal in this trend was in the area of spelling at the sixth grade level (Table 3).

IQ: There was a difference of about nine IQ points between fourth graders on the one hand and fifth and sixth graders on the other on the Pre-test. Gains in IQ ranged from 3.5 points for fifth graders to 5.7 points for fourth graders (Figure 5).

LR: In all three areas tested, fourth grade students had the lowest prior learning rate and sixth grade students had the highest. The average gain in LR was 32 % from Pre- to Post-test, except in the area of vocabulary at grades four and five where there was no gain in LR, and in spelling at the sixth grade level, where the students lost an average of 36% in LR from Pre- to Post-test. Sixth grade students only gained five months in spelling when they were expected to gain about seven months (Figure 6).

Conclusions: There are obvious differences among the three grades in terms of acquired skills. However, fifth and sixth grade students made greater gains than fourth grade students, which may indicate the Vocabulary Development Project was more effective with the older children.

RACIAL DIFFERENCES

VDP: Although black students scored lower on the Pre-test than white students, black students scored higher, on the average, on both Re-test and Mastery tests (Figure 7).

SAT: Black students scored initially lower than white students in all three areas tested; amount of absolute gain, however, was similar for both groups. Actual gain exceeded expected gain by two-four months for black students and zero-two months for white students (Table 4).

IQ: Black students had lower pre- IQ scores than whites (91.7 vs. 102.3). Both groups made similar absolute gains (Figure 7).

LR: Black students began with LR's less than 100 percent in all three areas tested, while white students began with LR's of

at least 100 percent. Yet black students showed an average of LR gain of 40 percent, while white students lost an average of 9 percent (Figure 8).

Conclusions: The Vocabulary Development Project gains for black students apparently influenced their Post-test scores which magnified post learning rates. In terms of increasing LR, the VDP was more successful with black students. This conclusion should be tempered by the knowledge that estimates of white students' scores are generally unreliable, as discussed earlier.

SEX X IQ DIFFERENCES

VDP: Significant differences in Pre-test, Re-test, and Mastery test scores between High and Low IQ groups were not related in any consistent manner to sex of the students. The differences in each case were slight and not statistically significant (Figure 9).

SAT: For Low IQ students, there were essentially no differences between boys and girls in Vocabulary and Comprehension tests, either before or after the project. Low IQ girls, however, had significantly higher scores in spelling on both Pre- and Post-test. For High IQ students, boys did significantly better than girls on both Pre-test and Post-test in Vocabulary and Comprehension; there were no consistent differences between High IQ girls and boys in the area of Spelling. Actual gains exceeded expected gains by 0--three months. with the exception of High IQ boys who did slightly less well than expected in the area of Vocabulary (Table 5).

IQ: For both girls and boys, Low IQ students made greater gains from Pre- to Post-test than High IQ students. The differential rates of gain were slight, however (Figure 9).

LR: Learning rates increased for Low IQ boys and girls in all three areas tested; in the High IQ group, however, only the Comprehension LR was increased for both sexes. In Vocabulary and Spelling, the High IQ boys and girls showed slight or no gain in LR (Figure 10).

Conclusions: Generally, the interaction of Sex with IQ was not significant; High IQ students simply did better than Low IQ students, and girls and boys (with some exceptions) did about the same. High IQ boys and girls made similar absolute gains in the areas of Vocabulary and Comprehension, but since the High IQ girls had lower Pre-test scores, their learning rate gain was appropriately greater than for High IQ boys.

SEX X GRADE DIFFERENCES

VDP: The differences between boys and girls were small in each of the three grades. Fourth grade boys and girls apparently

retained less than children from the other two grades (Figure 11).

SAT: In general, differences among the three grades at the beginning of the project were maintained at the end of the project. Both boys and girls made similar gains at each grade level with one major exception: sixth grade girls made spectacular gains in Vocabulary and Comprehension, but made less than half of their expected Post-test score in Spelling (Table 6).

IQ: The intelligence test scores of the boys and girls were approximately the same, and gains were nearly the same at each grade level. Increases in paper and pencil IQ test scores were unrelated to sex or grade (Figure 11).

LR: In Vocabulary, LR's stayed about the same except for grade six girls who, because of their spectacular gains on the Vocabulary test, showed a post LR almost double that of their prior LR. In Comprehension, all groups, especially grade six girls, significantly increased their LR's. In the area of Spelling, grade six girls fell dramatically from pre- to post-learning rates; grade six boys also dropped, but to a lesser degree; boys and girls in grades four and five showed a marked increase in Spelling learning rates (Figure 12).

Conclusions: Boys and girls made similar progress within each grade level with the exception of grade six girls. No immediate explanation is apparent for the confusing performance of this latter group.

SEX X RACE DIFFERENCES

VDP: The differences between sexes within each race were approximately zero for the Pre-test, Re-test, and Mastery test. Black females and white males scored lowest on the Pre-test, but scored highest on the Mastery test. Differences among the four sub-groups were slight, however (Figure 13).

SAT: The gains by the various groups were about the same for all three tests. However, actual gains exceeded expected gains by an average of three months for black students and only one month for white students. Thus, black students made greater relative gains than white students, but the difference was not related to sex (Table 7).

IQ: There were practically no differences in the gains on the IQ test among the groups, although black students had lower Pre-test scores than white students (Figure 13).

LR: Differences among the four sub-groups were inconsistent in terms of LR. Generally, boys and girls of both races had higher post LR's than prior LR's with the exception of white males, who showed a significant decline in the areas of Vocabulary and Reading Comprehension. Both male and female black students showed sizeable increases in LR in all three areas tested (Figure 14).

Conclusions: Black students of both sexes were able to increase their LR's significantly. Interactions of race with sex were generally negligible, the sole exception begin a pronounced decline in Comprehension learning rate for white male students. This sub-group failed to achieve the Post-test Comprehension score predicted by their prior learning rate of 120 percent.

IQ X GRADE DIFFERENCES

VDP: For both High and Low IQ groups, the sixth grade students obtained higher Pre- and Re-test scores than the fifth grade. In turn, the fifth grade did better than the fourth grade. All three grades had higher Mastery test scores than Pre-test scores, indicating retention of an increasing vocabulary. Within each grade, the High IQ group had higher scores than the Low IQ group on the Mastery test (Figure 15).

SAT: The fourth, fifth, and sixth grade High IQ students had generally higher test scores and made larger absolute gains than the corresponding Low IQ groups. The differences between actual and predicted gains were not related to IQ level, grade, or the combination of these two factors. The actual Post-test scores exceeded the expected Post-test scores by an average of 1.5 month (Table 8).

IQ: In all three grades, the Low IQ group made larger increases in their IQ scores than the High IQ group, although the differences were trivial (Figure 15).

LR: In all three grades, the Low IQ groups made larger gains in their learning rates in Vocabulary, similar gains in Comprehension, and mixed gains in Spelling. In the area of Spelling, Low IQ grade five students showed a gain of about 80 percent in LR, while High IQ grade six students declined about 50 percent (Figure 16).

Conclusions: Clearly, there were differences in absolute achievement levels among the three grades and between High and Low IQ groups. High IQ groups were expected to show higher levels of performance, and the older children should have performed better than younger ones. When learning rates are considered, however, the Low IQ children seemed

to have made greater increases than their High IQ counterparts in each grade. This same pattern was demonstrated in the analysis of IQ test scores.

IQ X RACE DIFFERENCES

VDP: The black and white Low IQ groups had approximately the same Pre-test scores; black and white High IQ groups had approximately the same average Pre-test score. However, for both the Low and High IQ groups, black students scored higher than the white students on both the Re-test and Mastery test (Figure 17).

SAT: The High IQ groups made larger gains in all three areas. With the exception of Spelling scores for the High IQ group, the black students made larger gains than white students. A similar trend was also noted in the Low IQ groups. Post-test scores, on the average, exceeded expected scores by about two and one-half months for black students and only one-half month for white students (Table 9).

IQ: The Low IQ group made slightly larger gains in IQ than did the High IQ group; however, within each IQ level, gains made by white and black children were about equal (Figure 17).

LR: The High and Low IQ black students made large increases in their learning rates in Vocabulary and Comprehension; smaller gains were made in Spelling. White students either maintained their progress or showed smaller LR's at the end of the project (except for Low IQ white students, who made a gain of about 30 percent in Spelling LR). High IQ black students gained more than 100 percent in Comprehension LR (Figure 18).

Conclusions: Differences between black and white students within the same IQ level on the "pre" achievement tests were minor; black students made greater absolute gains in Vocabulary and Comprehension achievement tests which, we feel, is almost certainly related to the degree of improvement shown on the Vocabulary Development Project Re-test and Mastery test data. Since black students began with lower LR's than white students, the performance of this group magnified post LR's.

RACE X GRADE DIFFERENCES

VDP: Generally, blacks had lower Pre-test scores and higher Re-test and Mastery test scores than white children at all three grade levels (Figure 19).

SAT: Although black students started at lower levels than white children in all three areas tested at each grade level, blacks made greater absolute gains than white students at all three grade levels in all areas tested except in Spelling at the fourth and sixth grade levels. Otherwise, blacks made greater gains than whites at each grade level. Black students exceeded their expected scores by an average of two and one-half months, while the same figure for white students is only one-half month (Table 10).

IQ: Black students had lower prior IQ scores than whites at each grade level and lower post IQ scores at each grade level. Both black and white students made similar gains (Figure 19).

LR: Blacks had lower prior learning rates in each area tested at each grade level than whites. With the exception of Spelling, grades four and five, however, black students had higher post LR's than whites and, consequently, higher rates of gain. Sixth grade students of both races did not do as well as expected in Spelling (Figure 20).

Conclusions: Generally, there was no differential effect attributable to grade level. Black students, on the whole, started out at lower levels than their white counterparts but made greater gains, both in terms of achievement test scores and learning rates. This effect was less noticeable at the fourth grade level.

## GENERAL CONCLUSIONS AND SUMMARY

The data generated by this pilot project have been analyzed and reported in some detail. Quite clearly, we could analyze the data in additional ways, but the results of the breakdowns reported here seem to answer the simple questions we asked at the beginning of the project: Can we significantly alter the scholastic performance of students by subjecting them to a rigorous program of vocabulary development? Our data indicate that we can make better than expected gains. IQ scores increased an average of some four points; actual gain from pre- to post-achievement test scores was one to three months more than would have been expected if the children had maintained their prior rate of learning; and the students seemed to retain some of the words they had been taught: the overall gain from Pre-test to Re-test was about 20 percent, while the average drop from Re-test to Mastery test was only 10 percent, reflecting a net gain of about 10 percent in word power.

Hopefully, the fine gains reflected in IQ scores and achievement test scores were the result of the Vocabulary Development Project. Of course, operations other than the project may have been responsible for gains. Other possible alternative causes are:

a) Regression toward the mean. This purely statistical artifact may have been responsible for the gains, but it is not very likely. In the analyses involving the IQ split, we would expect Low IQ children to approach the mean and High IQ children to "regress" toward the mean; this was not the case. In every analysis performed, both High and Low IQ groups made positive gains. A similar analysis is appropriate for the achievement test results--the students began at roughly grade level but made gains greater than seven months, the duration of the project.

b) Learning rate as an inappropriate measure. We have made much use in this report of "learning rate," a measure of rate of progress derived from achievement test score and number of years spent in school. Some might argue, perhaps justifiably, about the inadequacy of this measure as an indicator of performance. A child with a learning rate of 3/4 = 75% in the fourth grade would be expected to show a learning rate of 6/8 = 75% in the eighth grade. In other words, over a four-year period of time, maintenance of the same learning rate will result in a child who is performing two years behind grade level instead of only one. On the other hand, the bright student with a learning rate of 5/4 = 120% in the fourth grade must achieve 10/8 = 120% in the eighth grade--he has to keep improving, in other words. The same student in the twelfth grade would have to score 15.0 (college junior?) on a hypothetical achievement test to maintain his learning rate of 120 percent, a patently absurd extension of the concept of learning rate.

We assume in this paper that learning rate is a fairly good description of rate of achievement if it is interpreted cautiously. A learning rate of 200 percent (High IQ black students, post-comprehension learning rate, Figure 18) is obviously an invalid indicator of "true" rate of learning; yet, it does reflect a sizeable increase in performance predicted by prior achievement.

Ignoring learning rate for the moment, consider only the gain expected on achievement tests over a period of seven months. The average gain should be about seven months. We know that students perform differently on achievement tests--the tests and the children are designed that way. But, on the average, students should show about a month's gain for a month's school work. The 408 children in this project showed gains in the seven-month period ranging from eight to nine months. Intuitively, we see that the children did significantly better than expected. Learning rate is simply a convenient way of summarizing the information outlined in this paragraph, and should be interpreted accordingly.

c) Sampling biases. There were at least three sources of possible bias in the selection of the children who comprised the sample for the statistical analyses:

(1) Only those children who were available for both Pre- and Post-testing were used in the analyses. About 550 children participated, but only 408 had useable data. Clerical errors resulted in the loss of a small percentage of the original population, but the greatest loss was attributable to transient students who have been shown to achieve at lower levels, on the average, than children who do not move often. If data from all 550 children had been available for analysis, the gains would have been less dramatic - but real, nonetheless.

(2) Of the 408 children in the statistical sample, only 300 (75 percent) had data which would allow us to compute learning rates. Since we found no statistically significant differences between children for whom we knew "years in school" and those for whom we did not, we assumed that the variable "years in school" was appropriate for all children in a particular sub-group; therefore, we used learning rates computed on those children who had this data in the computation of expected achievement test scores for the whole sub-group. Incidentally, if data relating to "years in school" were available, this meant that the child had spent his entire school career in the St. Louis public school system.

(3) The largest source of bias was in the initial selection of the sample for the pilot project. Each of six District Superintendents chose a school from his district to participate in the Vocabulary Development Project; in turn, each school principal chose a "representative" fourth grade, fifth grade, and sixth grade. The selection of the sample was obviously not random. Some principals clearly chose classes (and teachers) which would do well in the project; other classes were probably chosen on other criteria. For example, one fourth grade class went from an average of 36 percent correct on Pre-test to 66 percent on Re-test to 48 percent on Mastery test; another fourth grade class went from 46 percent to 66 percent to 51 percent on Pre-test, Re-test, and Mastery test, respectively. Children in the former class had an average pre-IQ of 83, while students in the latter class had an average pre-IQ of 105. Both classes gained an average of 7 IQ points, but the former class showed greater gains in Comprehension and Vocabulary. It seems likely that in the former instance, the principal chose a low-achievement class with a teacher who would involve herself with the project, while the latter class was chosen primarily on the basis of previous high achievement.

The non-random selection of the sample clearly tempers any firm conclusions to be drawn from the results of the pilot project in that predictions about the performance of a larger group of children drawn from the same pool as the sample cannot be made with any real degree of assurance.

d) Practice effects and the development of learning sets. One reason many children perform poorly on paper and pencil examinations (e.g., Lorge-Thorndike IQ test and standardized achievement tests) is a lack of practice in standardized test-taking situations. Younger children are especially vulnerable to this lack of practice; as children grow older, supposedly their scores reflect more accurately their "actual" level of achievement because they are not so unfamiliar with following directions, marking answer sheets, etc. The underprivileged child is more likely to suffer as a result of lack of practice. In the Vocabulary Development Project, children had ample opportunity to practice test-taking behavior (90 Pre-tests, 90 Re-tests, and 10 Mastery tests) and direction-following behavior via the radio programs. Conceivably, the large amounts of practice during the project may have influenced Post-test scores on the achievement and IQ tests to a large extent. Evidence supporting this interpretation is found in the formation of "learning sets" as shown by the analysis of the daily results of the Pre-test, Re-test sequence. Routinely, children scored an average of 37 percent, 47 percent, and 58 percent correct on Pre-test in grades four, five, and six respectively (Figure 5). These average percentages correct were relatively consistent across all 90 Pre-tests. On Re-test, children in grades four, five, and six scored an average of 55 percent, 71 percent, and 81 percent correct respectively; however, Re-test scores at the beginning of the project were lower than Re-test scores in the middle of the project which, in turn, were lower than Re-test scores near the end of the project. Even though the words became progressively more difficult (had lower frequencies of occurrence in Thorndike's word book), children scored progressively higher on Re-test--they apparently learned how to learn. Responses competing with the act of answering questions (such as worrying about which block to mark, making adequate erasures, or test-taking anxiety) apparently were extinguished to some degree during the course of the project, thereby allowing children to concentrate more fully on the content of their answers rather than the format.

It is not difficult to see how practice effects and the related formation of learning sets would generalize to Post-testing to produce larger gains than would be expected if the children had not had the practice.

e) The Hawthorne effect. The last alternative cause, besides the direct effects of the project itself, is that the children (and their teachers) performed so well because they were aware of the evaluation effort and that results achieved in the pilot project would form the basis for extending the project to some 30,000 children. In other words, teachers (and to a lesser extent their children) may have felt an unusual pressure to make the project a success. The effects of this pressure are particularly difficult to assess but may have been partly responsible for the large gains shown in the children's performance.

We have discussed five alternative factors which may have contributed to the success of the project. Some probably played a relatively minor role in the results. We cannot estimate the effect of some of the others. We hope that we can build in the Hawthorne effect in all future applications of the materials.

Perhaps the clearest evidence that the Vocabulary Development Project was the primary cause of the gains observed over the course of the seven months is to be found in the "Racial Analysis" (Table 4, Figures 7 and 8). Black students started at lower levels than white students but made similar absolute gains in Vocabulary, Reading Comprehension, and Spelling (eight-nine months). Because of their lower prior learning rate, however, black children were only expected to gain five or six months; white children were expected to gain seven or eight months. When compared with baseline data, black children clearly outperformed white children in this sample. Black children gained a median 32 % (84%--116%) in learning rate, while white children lost a median 12 % (110%--98%) in learning rate.

It also happened that black children also scored higher on the Re-tests and Mastery tests of the Vocabulary Development Project after beginning at lower levels. Thus, it is clear that performance on the Pre-test, Re-test, and Mastery test teaching package is related to increased levels of achievement. This discussion is not intended to point out differences between races; the point is that differential performance between two sub-groups of children on the VDP led to differential rates of gain on achievement tests. A similar, but less pronounced, effect is revealed in the "sex" analysis. Girls increased their median learning rate by about 19%, while boys only increased a median of 8% (Figure 2). Girls also scored slightly higher on Re-tests and Mastery Tests after making scores somewhat less than boys on the Pre-tests.

## SUMMARY

Available evidence supports the conclusion that the VDP yields gains in achievement which are greater than normally expected. Paper and pencil measures of intelligence also increased some four--five points on the average. Because of the non-randomness of the sample, it is impossible to say unequivocally that particular sub-groups of children benefit more from the project than others, at least as far as sex and race are concerned. Both High and Low IQ groups made about the same gains from Pre- to Post-test, but Low IQ children showed greater gains in learning rate than High IQ children. Although they made large gains, fourth grade children seemingly found the regimen of 20 words a lesson, four lessons a week too great to handle without becoming at least a little lost.

Plans were made and are being carried out in the present school year to limit the number of words to eight, three times per week for fourth graders. Changes in the content of the teaching package were also made. Instead of myths fourth graders have folk tales and fables. Fifth and sixth graders are continuing with 20 words, four times per week with no changes in the content of the teaching package.

# APPENDIX A

# Set A ■ PRE-TEST 1

## VOCABULARY DEVELOPMENT TESTS

*Directions:* Decide which of the four lettered words or word groups means the same or nearly the same as the numbered word at the left. Then mark an X in the square at the right having the same letter as the answer you consider correct.

NAME _____

DATE _____ CLASS _____

SCHOOL _____

| | | | | | | a | b | c | d |
|---|---|---|---|---|---|---|---|---|---|
| *Example:* | above | a open | b under | c over | d about | ☐ | ☐ | ☒ | ☐ |
| 1 | accept | a receive | b deny | c except | d refuse | ☐ | ☐ | ☐ | ☐ |
| 2 | accompany | a go away | b accustom | c enter | d go with | ☐ | ☐ | ☐ | ☐ |
| 3 | accomplish | a fail | b get done | c prolong | d accident | ☐ | ☐ | ☐ | ☐ |
| 4 | active | a anxious | b dull | c tardy | d busy | ☐ | ☐ | ☐ | ☐ |
| 5 | actual | a awful | b fancy | c real | d across | ☐ | ☐ | ☐ | ☐ |
| 6 | admire | a admiral | b like | c object | d live | ☐ | ☐ | ☐ | ☐ |
| 7 | admit | a let in | b address | c let out | d deceive | ☐ | ☐ | ☐ | ☐ |
| 8 | adopt | a abandon | b make your own | c be against | d adapt | ☐ | ☐ | ☐ | ☐ |
| 9 | advance | a retreat | b advise | c go forward | d go before | ☐ | ☐ | ☐ | ☐ |
| 10 | adventure | a exciting experience | b borrow | c exercise | d experiment | ☐ | ☐ | ☐ | ☐ |
| 11 | affect | a charge | b except | c influence | d effect | ☐ | ☐ | ☐ | ☐ |
| 12 | afford | a do | b do without | c have the money for | d cross | ☐ | ☐ | ☐ | ☐ |
| 13 | aid | a hinder | b help | c hold | d aim | ☐ | ☐ | ☐ | ☐ |
| 14 | alarm | a silence | b garment | c clock | d warning | ☐ | ☐ | ☐ | ☐ |
| 15 | apparently | a motherly | b seemingly | c lightly | d vaguely | ☐ | ☐ | ☐ | ☐ |
| 16 | appeal | a appear | b begin | c beg | d command | ☐ | ☐ | ☐ | ☐ |
| 17 | appoint | a name | b dismiss | c defeat | d stab | ☐ | ☐ | ☐ | ☐ |
| 18 | approach | a depart | b come near | c come apart | d draw away | ☐ | ☐ | ☐ | ☐ |
| 19 | arrange | a disturb | b advance | c put in order | d ride | ☐ | ☐ | ☐ | ☐ |
| 20 | article | a like very much | b make you laugh | c be active | d particular thing | ☐ | ☐ | ☐ | ☐ |

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# Set A ■ RE-TEST 1 VOCABULARY DEVELOPMENT TESTS

*Directions:* Decide which of the four lettered words or word groups means the same or nearly the same as the numbered word at the left. Then mark an X in the square at the right having the same letter as the answer you consider correct.

SCORE _____

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | a | b c d |
| *Example:* | above | **a** open | **b** under | **c** over | **d** about | | ☐ ☐ ☒ ☐ |
| 1 | adventure | **a** exciting experience | **b** exercise | **c** borrow | **d** experiment | 1 | ☐ ☐ ☐ ☐ |
| 2 | affect | **a** effect | **b** influence | **c** charge | **d** except | 2 | ☐ ☐ ☐ ☐ |
| 3 | alarm | **a** clock | **b** silence | **c** warning | **d** garment | 3 | ☐ ☐ ☐ ☐ |
| 4 | appeal | **a** beg | **b** command | **c** appear | **d** begin | 4 | ☐ ☐ ☐ ☐ |
| 5 | article | **a** be active | **b** like very much | **c** particular thing | **d** make you laugh | 5 | ☐ ☐ ☐ ☐ |
| 6 | accompany | **a** enter | **b** go with | **c** go away | **d** accustom | 6 | ☐ ☐ ☐ ☐ |
| 7 | admit | **a** let out | **b** address | **c** deceive | **d** let in | 7 | ☐ ☐ ☐ ☐ |
| 8 | accept | **a** refuse | **b** receive | **c** deny | **d** except | 8 | ☐ ☐ ☐ ☐ |
| 9 | appoint | **a** dismiss | **b** defeat | **c** stab | **d** name | 9 | ☐ ☐ ☐ ☐ |
| 10 | arrange | **a** put in order | **b** ride | **c** disturb | **d** advance | 10 | ☐ ☐ ☐ ☐ |
| 11 | apparently | **a** seemingly | **b** vaguely | **c** motherly | **d** lightly | 11 | ☐ ☐ ☐ ☐ |
| 12 | approach | **a** draw away | **b** come apart | **c** come near | **d** depart | 12 | ☐ ☐ ☐ ☐ |
| 13 | active | **a** tardy | **b** busy | **c** anxious | **d** dull | 13 | ☐ ☐ ☐ ☐ |
| 14 | accomplish | **a** get done | **b** accident | **c** prolong | **d** fail | 14 | ☐ ☐ ☐ ☐ |
| 15 | actual | **a** across | **b** real | **c** awful | **d** fancy | 15 | ☐ ☐ ☐ ☐ |
| 16 | aid | **a** aim | **b** hold | **c** help | **d** hinder | 16 | ☐ ☐ ☐ ☐ |
| 17 | adopt | **a** adapt | **b** be against | **c** abandon | **d** make your own | 17 | ☐ ☐ ☐ ☐ |
| 18 | advance | **a** go before | **b** go forward | **c** retreat | **d** advise | 18 | ☐ ☐ ☐ ☐ |
| 19 | afford | **a** do without | **b** cross | **c** do | **d** have the money for | 19 | ☐ ☐ ☐ ☐ |
| 20 | admire | **a** like | **b** object | **c** admiral | **d** live | 20 | ☐ ☐ ☐ ☐ |

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# Set A ▪ MASTERY TEST

NAME _____ DATE _____

SCHOOL _____ CLASS _____ SCORE _____

| | | | | | |
|---|---|---|---|---|---|
| 1 | sigh | a sight | b close by | c long breath | d dance |
| 2 | yield | a yell | b football game | c give in | d air raid |
| 3 | vary | a be careful | b match | c change | d wear out |
| 4 | struggle | a give up | b strut | c stumble | d try hard |
| 5 | unite | a be a witness | b abandon | c untie | d bring together |
| 6 | superior | a very much better | b superman | c complete | d average |
| 7 | vain | a not occupied | b tricky | c fully | d without success |
| 8 | treaty | a action | b ice cream | c government agreement | d argument |
| 9 | volume | a voice | b value | c radio | d amount |
| 10 | tale | a tadpole | b story | c last part | d tablet |
| 11 | vast | a sleeveless jacket | b vase | c of great size | d voter |
| 12 | article | a like very much | b make you laugh | c be active | d particular thing |
| 13 | accomplish | a fail | b get done | c prolong | d accident |
| 14 | adopt | a abandon | b make your own | c to be against | d adapt |
| 15 | apparently | a motherly | b seemingly | c lightly | d vaguely |
| 16 | afford | a do | b do without | c have the money for | d can cross |
| 17 | appoint | a name | b dismiss | c defeat | d stab |
| 18 | active | a anxious | b dull | c tardy | d busy |
| 19 | admire | a admiral | b like | c object | d live |
| 20 | arrange | a to disturb | b to advance | c put in order | d to ride |
| 21 | accompany | a go away | b accustom | c enter | d go with |
| 22 | adventure | a exciting experience | b borrow | c exercise | d experiment |
| 23 | observation | a see and note | b obstruct | c take a poll | d do the opposite |
| 24 | involve | a impress | b rule out | c revolve | d bring into |
| 25 | generation | a generous | b persons in the military service | c generous amount | d age group |
| 26 | existence | a example | b exemption | c being | d income tax |
| 27 | impression | a effect | b staple | c presentation | d gift |
| 28 | neglect | a lose your way | b neutral zone | c meddle | d leave undone |
| 29 | instantly | a in front of | b constantly | c at once | d initially |
| 30 | federal | a feature | b national | c state | d city |
| 31 | expedition | a exhibition | b a trial run | c experience | d trip for a special purpose |
| 32 | lodge | a loafer | b boiled lobster | c a place to stay | d lobby |
| 33 | extent | a reach | b exception | c out of bounds | d detection |
| 34 | feature | a main thing | b feather | c faith in | d small part |
| 35 | commission | a favor | b modern | c pay for a sale | d committee |
| 36 | former | a latter | b earlier | c final | d hillbilly |
| 37 | colonel | a officer | b servant | c collector | d nut |
| 38 | contract | a law suit | b legal agreement | c opposite side | d touch |
| 39 | fate | a one's health | b faith | c belief | d one's lot |
| 40 | current | a custom | b curve | c flow | d raisin |
| 41 | council | a weapon | b planning group | c fighting group | d dispute |
| 42 | consent | a constant | b refuse | c agree | d argue |
| 43 | fleet | a slow | b smooth | c fast | d solid |
| 44 | decline | a refuse | b declare | c lie down | d accept |
| 45 | gaze | a peep | b stare | c star | d graze |
| 46 | local | a of a certain place | b relative | c lawful | d for no reason |
| 47 | occur | a happen | b occupy | c octopus | d hasten |
| 48 | herald | a announce | b denounce | c hesitate | d pray |

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| | | | | | |
|---|---|---|---|---|---|
| 49 journal | a travel | b daily record | c glued joint | d dairy |
| 50 observe | a obstruct | b watch | c wave | d object |
| 51 issue | a insult | b send out | c insure | d sample |
| 52 oppose | a write a song | b favor | c order | d be against |
| 53 justify | a juggle | b deny the right | c show to be right | d give more time |
| 54 occasion | a television | b octopus | c close friend | d special time |
| 55 murmur | a mummy | b soft purring sound | c a musical note | d loud sound |
| 56 series | a things out of order | b things in a row | c work done for another | d illness |
| 57 region | a reign | b army | c regiment | d area |
| 58 original | a occupied | b not a copy | c out in space | d not often |
| 59 practically | a presently | b completely | c ready | d almost |
| 60 route | a shape of circle | b way to go | c rut | d routine |
| 61 senate | a lawmaking group | b official | c officer | d senior citizen |
| 62 proportion | a share | b offer | c property | d office |
| 63 seize | a leave alone | b lay hold of | c let go | d seat |
| 64 portion | a position | b partner | c part | d whole |
| 65 secure | a dangerous | b healthy | c anxious | d safe |
| 66 principle | a role | b discipline | c principal | d rule |
| 67 bold | a during | b bolt | c daring | d soap |
| 68 basis | a basin | b formation | c bison | d base |
| 69 administration | a final examination | b comedian | c persons in charge | d members of a congregation |
| 70 acquaintance | a sample | b someone you know | c a close friend | d a stranger |
| 71 approve | a think well of | b apply for | c give evidence | d work for |
| 72 ambition | a desire for success | b adding of numbers | c failure | d admiration |
| 73 abroad | a overheard | b overhead | c in the water | d out of the country |
| 74 beam | a antenna | b wildcat strike | c ray of light | d seed pod |
| 75 assembly | a meeting | b assignment | c design | d aspirin |
| 76 agent | a one who forsakes | b agitator | c demonstrator | d person acting for another |
| 77 associate | a assortment | b partner | c misfit | d enemy |
| 78 discuss | a release | b break up | c talk over | d dismiss |
| 79 dread | a be calm | b dream | c favor highly | d fear greatly |
| 80 endure | a forecast | b forbid | c limit | d last |
| 81 erect | a rubbed out | b straight up | c mobile | d extended |
| 82 brilliant | a dull | b brittle | c bright | d bristle |
| 83 commercial | a charitable | b for profit | c religious | d voluntary |
| 84 contrary | a opposite | b contagious | c similar to | d regular |
| 85 career | a strive | b carve | c award | d life work |
| 86 dispute | a accuse | b dismiss | c compute | d argue |
| 87 counsel | a counter | b advice | c advance | d count-down |
| 88 bureau | a part of a building | b department of government | c balloon | d burden |
| 89 civil | a policy | b chill | c polite | d chief |
| 90 cast | a throw | b story | c case | d twist |
| 91 authority | a principle | b power to do | c assembly | d novelist |
| 92 association | a individual | b assistance | c being polite | d people working together |
| 93 beneath | a beside | b under | c refuse | d banish |
| 94 cell | a buy something | b small room | c bargain | d purchase |
| 95 chamber | a charm | b cottage | c room | d charter |
| 96 circumstances | a circles | b clowns | c choices | d conditions |
| 97 century | a annual | b one hundred percent | c center | d one hundred years |
| 98 attitude | a altitude | b way of feeling | c feel proud | d weight |
| 99 assure | a hesitate | b censure | c make certain | d make a guess |
| 100 average | a avenue | b original | c rare | d ordinary |

# APPENDIX B

[ Appendix B ]

## THE TALE OF KING MIDAS AND THE MAGIC TOUCH

After an adventurous career as a bold conquerer, King Midas (mi'dəs) found the quiet domestic life of his royal palace growing dull. Then one day Midas beheld Mercury (mėr'kyərē), the herald of divine Jupiter (jů'pətər), emperor of the gods who dwelled on Mount Olympus (ō lim'pəs), descend to the earth.

"Apparently you are sad, Midas," said Mercury curiously. "Your men have erected this enormous palace for you. Your commercial vessels are constantly abroad to bring sufficient precious gold and silver to your ports. You should be very happy."

"On the contrary," sighed Midas; "I must dispute that. My ambition, you see, is to obtain more gold than anyone else in all the world. If only the gods would grant my wish!"

"I haven't time to discuss it," said Mercury, "but I counsel you to choose more wisely. Actually, the gods have given me authority to grant you one wish."

"Then I appeal to you, I urge you to let everything I touch turn into gold!" cried Midas.

"It shall be as you bid," Mercury assured him.

Midas seized the delicate blossoms of a fruit tree. Instantly they shone with the brilliant blazing glow of gold. Midas trembled with joy. He ran about and sought to touch every article he could reach. He opened the door of his bureau and seized his rich robes. They, too, turned instantly into gold. Utterly worn out, he stopped for a drink of water. But the water became gold when it touched his lips, --and Midas was thirsty. Now Midas began to be concerned. Suddenly his lovely little daughter came running to jump into his arms.

"Stop!" cried Midas anxiously. But his cry of alarm was in vain. Instantly the little girl's smiling features turned into lifeless gold.

"Oh!" cried Midas, "I cannot endure this dreadful gold any longer. I was greedy, I admit it. Oh, forgive me, gods!"

Instantly Mercury was again at his side. Everything became as it formerly was. Midas hugged his daughter happily.

"Perhaps you are a poorer, but you are now a wiser man," observed Mercury. Again he disappeared, this time never to return.

# APPENDIX C

Table 1

ACHIEVEMENT TEST RESULTS
FOR SEX ANALYSIS*

| | BOYS | GIRLS |
|---|---|---|
| Number of students | 191 | 217 |
| Years in school | 5.8 | 5.5 |
| **GATES-MAC GINITIE** | | |
| a) Vocabulary | | |
| Pre | 5.3 | 5.0 |
| Expected | 6.0 | 5.6 |
| Post | 6.1 | 5.8 |
| Expected Gain | .7 | .6 |
| Actual Gain | .8 | .8 |
| b) Comprehension | | |
| Pre | 5.0 | 4.8 |
| Expected | 5.6 | 5.4 |
| Post | 5.8 | 5.7 |
| Expected Gain | .6 | .6 |
| Actual Gain | .8 | .9 |
| **ITBS** | | |
| c) Spelling | | |
| Pre | 4.7 | 5.1 |
| Expected | 5.3 | 5.7 |
| Post | 5.5 | 5.9 |
| Expected Gain | .6 | .6 |
| Actual Gain | .8 | .8 |

*All achievement test scores expressed in grade equivalents (years)

Table 2

ACHIEVEMENT TEST RESULTS
FOR IQ ANALYSIS

| | HI (97+) | LO (96-) |
|---|---|---|
| Number of students | 204 | 204 |
| Years in school | 5.4 | 5.9 |
| **GATES-MAC GINITIE** | | |
| a) Vocabulary | | |
| Pre | 6.1 | 4.2 |
| Expected | 6.9 | 4.7 |
| Post | 7.0 | 4.9 |
| Expected Gain | .8 | .5 |
| Actual Gain | .9 | .7 |
| b) Comprehension | | |
| Pre | 6.1 | 3.7 |
| Expected | 6.9 | 4.2 |
| Post | 7.2 | 4.3 |
| Expected Gain | .8 | .5 |
| Actual Gain | 1.1 | .6 |
| **ITBS** | | |
| c) Spelling | | |
| Pre | 5.7 | 4.1 |
| Expected | 6.5 | 4.6 |
| Post | 6.6 | 4.8 |
| Expected Gain | .8 | .5 |
| Actual Gain | .9 | .7 |

Table 3

ACHIEVEMENT TEST RESULTS
FOR GRADE ANALYSIS

| | 4 | 5 | 6 |
|---|---|---|---|
| Number of students | 140 | 141 | 127 |
| Years in school | 4.7 | 5.7 | 6.5 |
| **GATES-MAC GINITIE** | | | |
| a) Vocabulary | | | |
| Pre | 4.1 | 5.2 | 6.2 |
| Expected | 4.7 | 5.9 | 6.9 |
| Post | 4.8 | 6.0 | 7.2 |
| Expected Gain | .6 | .7 | .7 |
| Actual Gain | .7 | .8 | 1.0 |
| b) Comprehension | | | |
| Pre | 3.6 | 4.8 | 6.4 |
| Expected | 4.2 | 5.4 | 7.1 |
| Post | 4.3 | 5.7 | 7.4 |
| Expected Gain | .6 | .6 | .7 |
| Actual Gain | .7 | .9 | 1.0 |
| **ITBS** | | | |
| c) Spelling | | | |
| Pre | 3.7 | 5.1 | 6.3 |
| Expected | 4.3 | 5.7 | 7.0 |
| Post | 4.4 | 6.0 | 6.8 |
| Expected Gain | .6 | .6 | .7 |
| Actual Gain | .7 | .9 | .5 |

Table 4

ACHIEVEMENT TEST RESULTS
FOR RACE ANALYSIS

| | BLACK | WHITE |
|---|---|---|
| Number of students | 199 | 209 |
| Years in school | 5.8 | 5.5 |
| **GATES-MAC GINITIE** | | |
| a) Vocabulary | | |
| Pre | 4.7 | 5.5 |
| Expected | 5.3 | 6.3 |
| Post | 5.6 | 6.3 |
| Expected Gain | .6 | .8 |
| Actual Gain | .9 | .8 |
| b) Comprehension | | |
| Pre | 4.2 | 5.6 |
| Expected | 4.7 | 5.6 |
| Post | 5.1 | 6.4 |
| Expected Gain | .5 | .8 |
| Acutal Gain | .9 | .8 |
| **ITBS** | | |
| c) Spelling | | |
| Pre | 4.7 | 5.1 |
| Expected | 5.3 | 5.8 |
| Post | 5.5 | 6.0 |
| Expected Gain | .6 | .7 |
| Actual Gain | .8 | .9 |

Table 5

ACHIEVEMENT TEST RESULTS
FOR SEX X IQ ANALYSIS

| | MALE | | FEMALE | |
|---|---|---|---|---|
| | LO IQ | HI IQ | LO IQ | HI IQ |
| Number of students | 99 | 92 | 105 | 112 |
| Years in school | 6.0 | 5.5 | 5.8 | 5.3 |
| GATES-MAC GINITIE | | | | |
| a) Vocabulary | | | | |
| Pre | 4.2 | 6.6 | 4.2 | 5.7 |
| Expected | 4.7 | 7.5 | 4.7 | 6.5 |
| Post | 4.9 | 7.4 | 4.8 | 6.6 |
| Expected Gain | .5 | .9 | .5 | .8 |
| Actual Gain | .7 | .8 | .6 | .9 |
| b) Comprehension | | | | |
| Pre | 3.6 | 6.4 | 3.8 | 5.8 |
| Expected | 4.1 | 7.2 | 4.3 | 6.6 |
| Post | 4.3 | 7.5 | 4.4 | 6.9 |
| Expected Gain | .5 | .8 | .5 | .8 |
| Actual Gain | .7 | 1.1 | .6 | 1.1 |
| ITBS | | | | |
| c) Spelling | | | | |
| Pre | 3.8 | 5.7 | 4.3 | 5.8 |
| Expected | 4.3 | 6.5 | 4.8 | 6.6 |
| Post | 4.5 | 6.7 | 5.1 | 6.6 |
| Expected Gain | .5 | .8 | .5 | .8 |
| Actual Gain | .7 | 1.0 | .8 | .8 |

Table 6

ACHIEVEMENT TEST RESULTS
FOR SEX X GRADE ANALYSIS

| | MALE | | | FEMALE | | |
|---|---|---|---|---|---|---|
| | 4 | 5 | 6 | 4 | 5 | 6 |
| Number of students | 72 | 57 | 62 | 68 | 84 | 65 |
| Years in school | 4.8 | 6.0 | 6.7 | 4.7 | 5.6 | 6.4 |
| **GATES-MAC GINITIE** | | | | | | |
| a) Vocabulary | | | | | | |
| Pre | 4.1 | 5.4 | 6.7 | 4.2 | 5.1 | 5.7 |
| Expected | 4.7 | 6.1 | 7.4 | 4.8 | 5.8 | 6.3 |
| Post | 4.8 | 6.4 | 7.5 | 4.7 | 5.7 | 6.9 |
| Expected Gain | .6 | .7 | .7 | .6 | .7 | .6 |
| Actual Gain | .7 | 1.0 | .8 | .5 | .6 | 1.2 |
| b) Comprehension | | | | | | |
| Pre | 3.6 | 4.9 | 6.7 | 3.7 | 4.7 | 6.1 |
| Expected | 4.2 | 5.5 | 7.4 | 4.3 | 5.3 | 6.8 |
| Post | 4.2 | 5.9 | 7.6 | 4.5 | 5.6 | 7.2 |
| Expected Gain | .6 | .6 | .7 | .6 | .6 | .7 |
| Actual Gain | .6 | 1.0 | .9 | .8 | .9 | 1.1 |
| **ITBS** | | | | | | |
| c) Spelling | | | | | | |
| Pre | 3.5 | 4.9 | 6.3 | 3.9 | 5.2 | 6.3 |
| Expected | 4.0 | 5.5 | 7.0 | 4.5 | 5.9 | 7.0 |
| Post | 4.2 | 5.7 | 6.9 | 4.8 | 6.2 | 6.6 |
| Expected Gain | .5 | .6 | .7 | .6 | .7 | .7 |
| Actual Gain | .7 | .8 | .6 | .9 | 1.0 | .3 |

Table 7

ACHIEVEMENT TEST RESULTS
FOR SEX X RACE ANALYSIS

| | MALE | | FEMALE | |
|---|---|---|---|---|
| | BLACK | WHITE | BLACK | WHITE |
| Number of students | 92 | 99 | 107 | 110 |
| Years in school | 6.0 | 5.5 | 5.7 | 5.4 |
| GATES-MAC GINITIE | | | | |
| a) Vocabulary | | | | |
| Pre | 4.9 | 5.8 | 4.6 | 5.3 |
| Expected | 5.5 | 6.6 | 5.2 | 6.0 |
| Post | 5.7 | 6.6 | 5.5 | 6.0 |
| Expected Gain | .6 | .8 | .6 | .7 |
| Actual Gain | .8 | .8 | .9 | .7 |
| b) Comprehension | | | | |
| Pre | 4.1 | 5.8 | 4.3 | 5.4 |
| Expected | 5.6 | 6.6 | 4.8 | 6.2 |
| Post | 5.2 | 6.4 | 5.1 | 6.3 |
| Expected Gain | .5 | .8 | .5 | .8 |
| Actual Gain | 1.1 | .6 | .8 | .9 |
| ITBS | | | | |
| c) Spelling | | | | |
| Pre | 4.5 | 4.9 | 4.9 | 5.2 |
| Expected | 5.1 | 5.6 | 5.5 | 5.9 |
| Post | 5.2 | 5.9 | 5.7 | 6.0 |
| Expected Gain | .6 | .7 | .6 | .7 |
| Actual Gain | .7 | 1.0 | .8 | .8 |

Table 8

ACHIEVEMENT TEST RESULTS
FOR IQ X GRADE ANALYSIS

| | HI IQ | | | LO IQ | | |
|---|---|---|---|---|---|---|
| | 4 | 5 | 6 | 4 | 5 | 6 |
| Number os students | 50 | 77 | 77 | 90 | 64 | 50 |
| Years in school | 4.1 | 5.2 | 6.3 | 5.1 | 6.4 | 6.9 |
| GATES-MAC GINITIE | | | | | | |
| a) Vocabulary | | | | | | |
| Pre | 5.1 | 5.9 | 7.0 | 3.6 | 4.4 | 5.0 |
| Expected | 6.0 | 6.7 | 7.8 | 4.1 | 4.9 | 5.5 |
| Post | 5.8 | 6.7 | 8.0 | 4.2 | 5.2 | 5.8 |
| Expected Gain | .9 | .8 | .8 | .5 | .5 | .5 |
| Actual Gain | .7 | .8 | 1.0 | .6 | .8 | .8 |
| b) Comprehension | | | | | | |
| Pre | 4.7 | 5.6 | 7.5 | 3.1 | 3.8 | 4.7 |
| Expected | 5.5 | 6.4 | 8.3 | 3.5 | 4.2 | 5.2 |
| Post | 5.6 | 6.6 | 8.8 | 3.6 | 4.6 | 5.3 |
| Expected Gain | .8 | .8 | .8 | .4 | .4 | .5 |
| Actual Gain | .9 | 1.0 | 1.3 | .5 | .8 | .6 |
| ITBS | | | | | | |
| c) Spelling | | | | | | |
| Pre | 4.5 | 5.6 | 7.0 | 3.2 | 4.5 | 5.2 |
| Expected | 5.3 | 6.4 | 7.8 | 3.7 | 5.0 | 5.8 |
| Post | 5.5 | 6.4 | 7.5 | 3.9 | 5.5 | 5.7 |
| Expected Gain | .8 | .8 | .8 | .5 | .5 | .6 |
| Actual Gain | 1.0 | .8 | .5 | .7 | 1.0 | .5 |

Table 9

ACHIEVEMENT TEST RESULTS
FOR IQ X RACE ANALYSIS

| | LO IQ | | HI IQ | |
|---|---|---|---|---|
| | WHITE | BLACK | WHITE | BLACK |
| Number of students | 69 | 135 | 140 | 64 |
| Years in school | 5.8 | 5.9 | 5.3 | 5.5 |
| GATES-MAC GINITIE | | | | |
| a) Vocabulary | | | | |
| Pre | 4.3 | 4.2 | 6.1 | 6.0 |
| Expected | 4.9 | 4.7 | 6.9 | 6.8 |
| Post | 4.9 | 4.9 | 7.0 | 7.0 |
| Expected Gain | .6 | .5 | .8 | .8 |
| Actual Gain | .6 | .7 | .9 | 1.0 |
| b) Comprehension | | | | |
| Pre | 3.9 | 3.6 | 6.4 | 5.5 |
| Expected | 4.5 | 4.0 | 7.3 | 6.2 |
| Post | 4.4 | 4.3 | 7.3 | 6.9 |
| Expected Gain | .6 | .4 | .9 | .7 |
| Actual Gain | .5 | .7 | .9 | 1.4 |
| ITBS | | | | |
| c) Spelling | | | | |
| Pre | 4.1 | 4.1 | 5.6 | 6.1 |
| Expected | 4.6 | 4.6 | 6.4 | 6.9 |
| Post | 4.8 | 4.8 | 6.5 | 6.9 |
| Expected Gain | .5 | .5 | .8 | .8 |
| Actual Gain | .7 | .7 | .9 | .8 |

Table 10

ACHIEVEMENT TEST RESULTS
FOR RACE X GRADE ANALYSIS

| | WHITE | | | BLACK | | |
|---|---|---|---|---|---|---|
| | 4 | 5 | 6 | 4 | 5 | 6 |
| Number of students | 70 | 70 | 69 | 70 | 71 | 58 |
| Years in school | 4.3 | 5.4 | 6.4 | 5.0 | 6.0 | 6.7 |
| GATES-MAC GINITIE | | | | | | |
| a) Vocabulary | | | | | | |
| Pre | 4.6 | 5.6 | 6.4 | 3.7 | 4.9 | 5.9 |
| Expected | 5.4 | 6.4 | 7.1 | 4.2 | 5.5 | 6.5 |
| Post | 5.2 | 6.3 | 7.3 | 4.3 | 5.7 | 7.0 |
| Expected Gain | .8 | .8 | .7 | .5 | .6 | .6 |
| Actual Gain | .6 | .7 | .9 | .6 | .8 | 1.1 |
| b) Comprehension | | | | | | |
| Pre | 4.2 | 5.3 | 7.1 | 3.1 | 4.2 | 5.5 |
| Expected | 5.0 | 6.1 | 7.9 | 3.5 | 4.7 | 6.1 |
| Post | 4.9 | 6.3 | 7.9 | 3.8 | 5.1 | 6.8 |
| Expected Gain | .8 | .8 | .8 | .4 | .5 | .6 |
| Actual Gain | .7 | 1.0 | .8 | .7 | .9 | 1.3 |
| ITBS | | | | | | |
| c) Spelling | | | | | | |
| Pre | 4.0 | 5.2 | 6.3 | 3.4 | 5.0 | 6.2 |
| Expected | 4.7 | 5.9 | 7.0 | 3.9 | 5.6 | 6.9 |
| Post | 4.9 | 6.0 | 6.9 | 4.0 | 6.0 | 6.6 |
| Expected Gain | .7 | .7 | .7 | .5 | .6 | .7 |
| Actual Gain | .9 | .8 | .6 | .6 | 1.0 | .4 |

# APPENDIX D

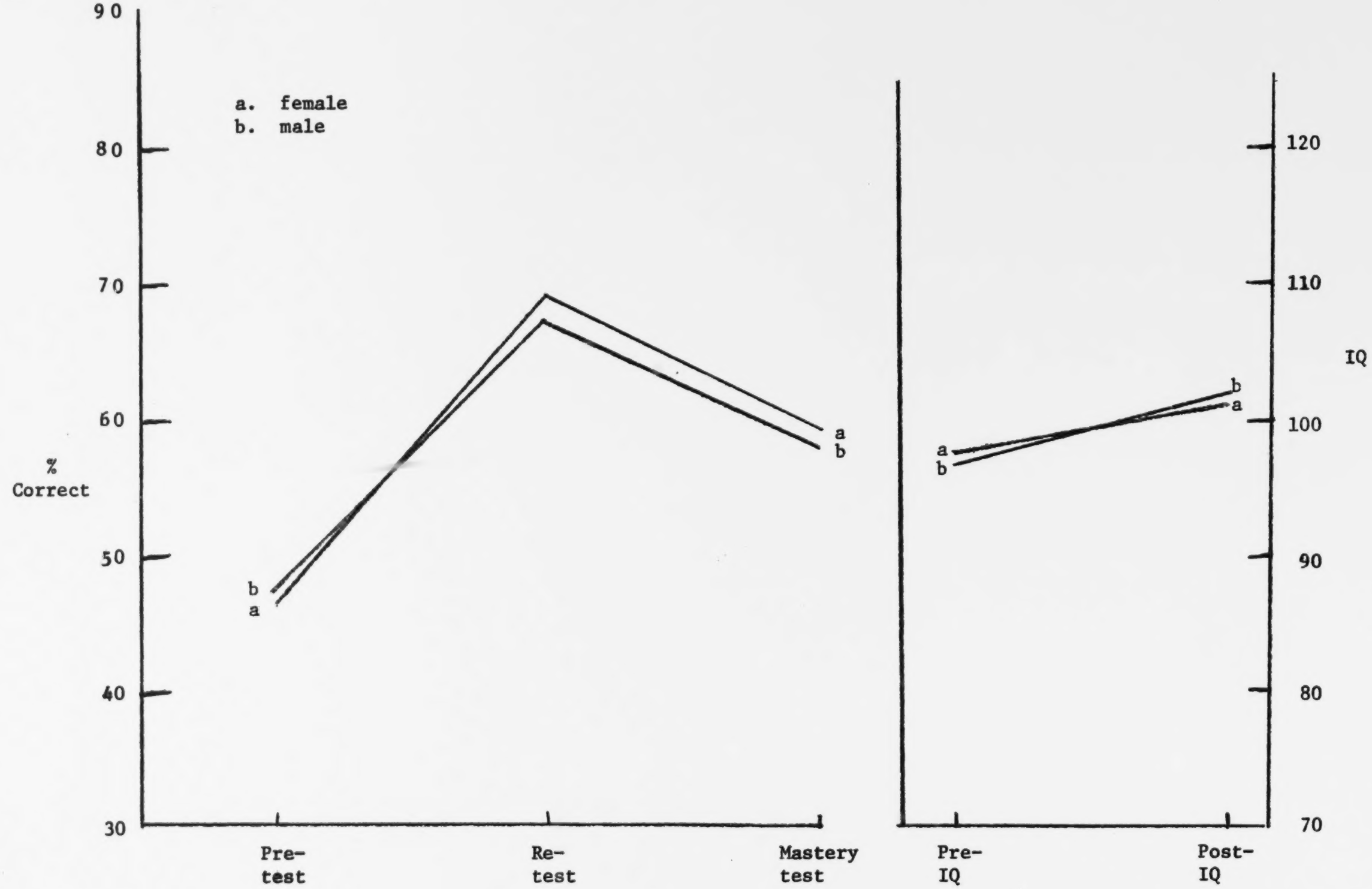


Figure 1. VOCABULARY PROJECT TEST RESULTS AND IQ CHANGES FOR SEX ANALYSIS

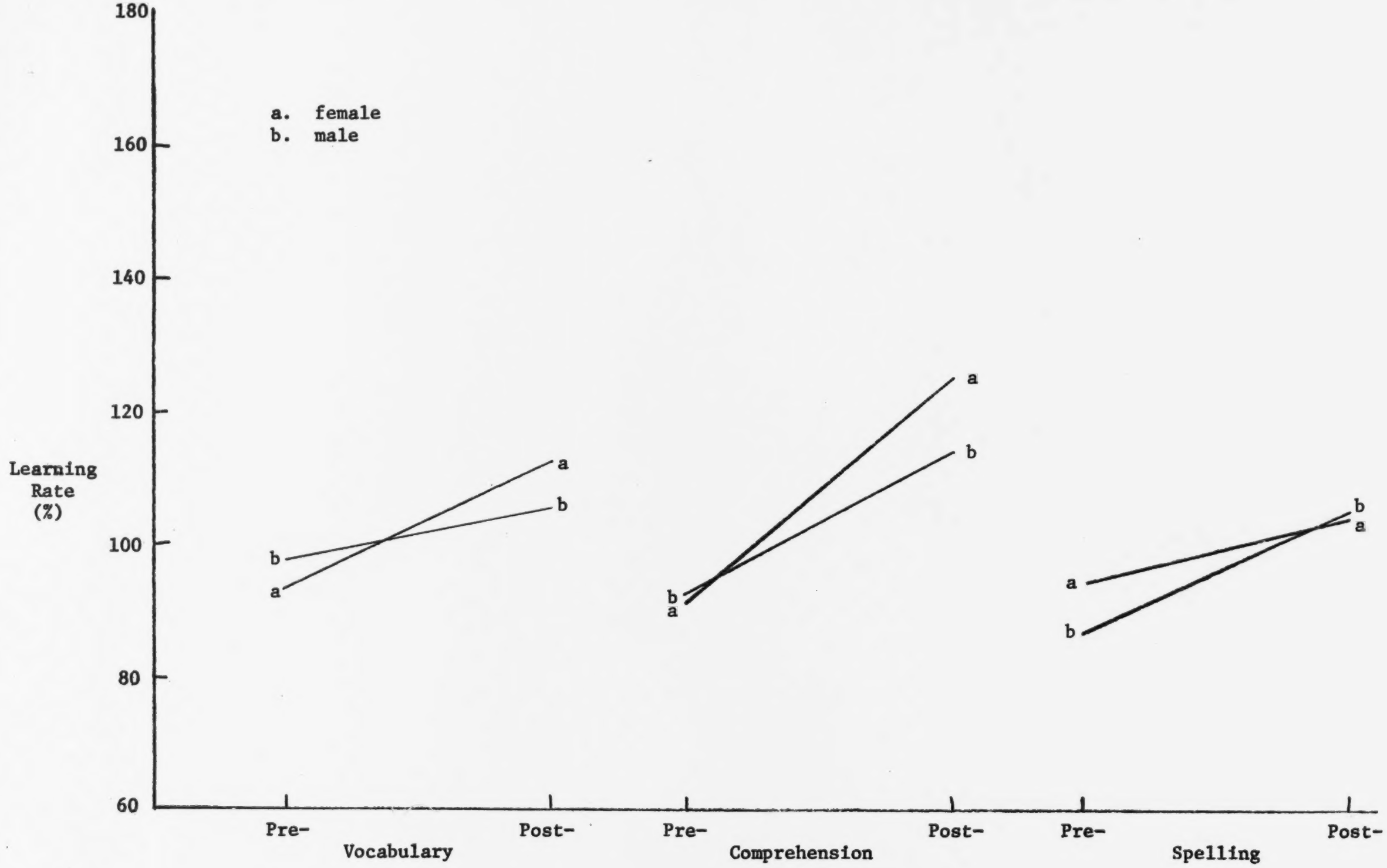


Figure 2. LEARNING RATES FOR SEX ANALYSIS

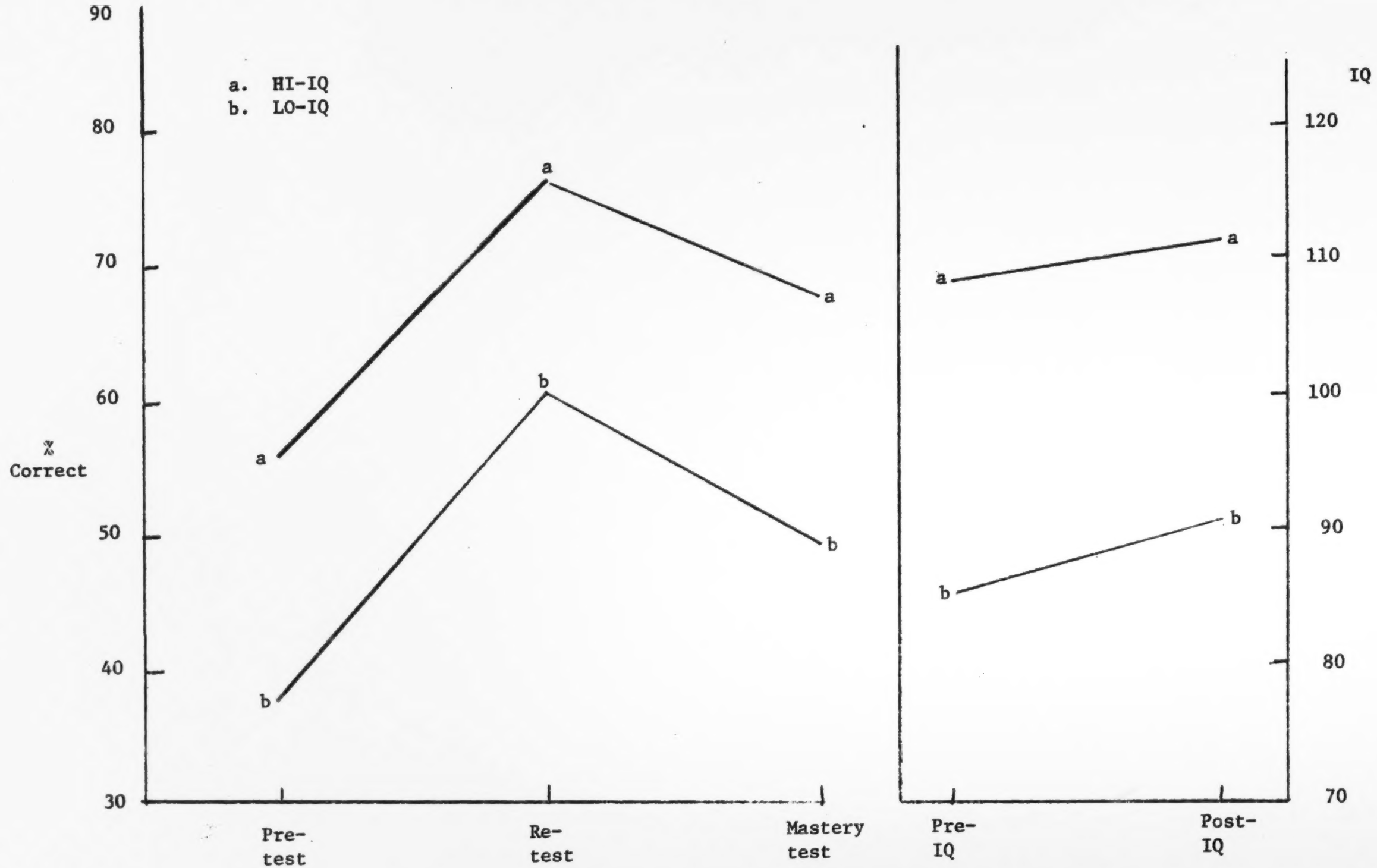


Figure 3. VOCABULARY PROJECT TEST RESULTS AND IQ CHANGES FOR IQ ANALYSIS

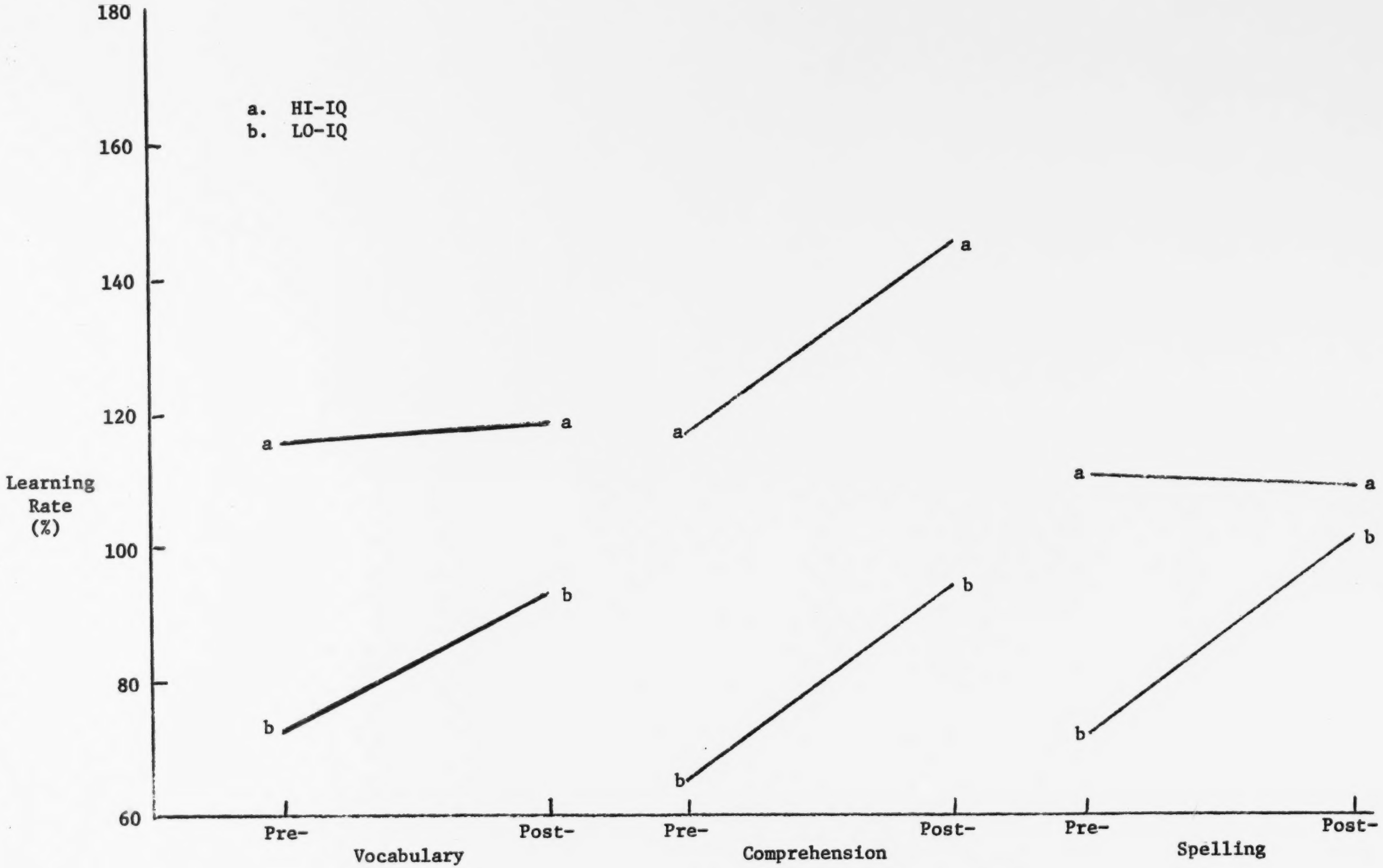


Figure 4. LEARNING RATE RESULTS FOR IQ ANALYSIS

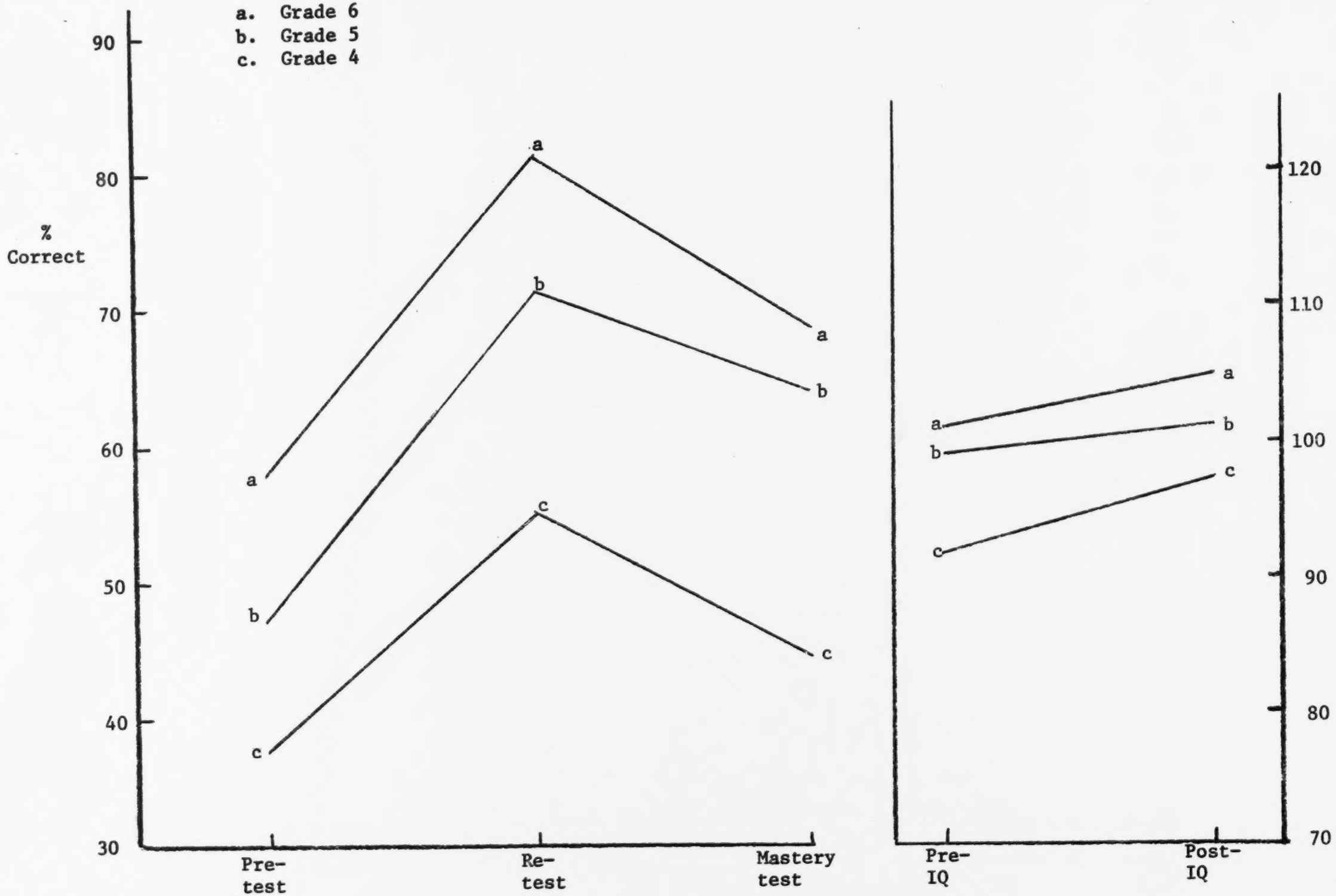


Figure 5. VOCABULARY PROJECT TEST RESULTS AND IQ CHANGES FOR GRADE ANALYSIS

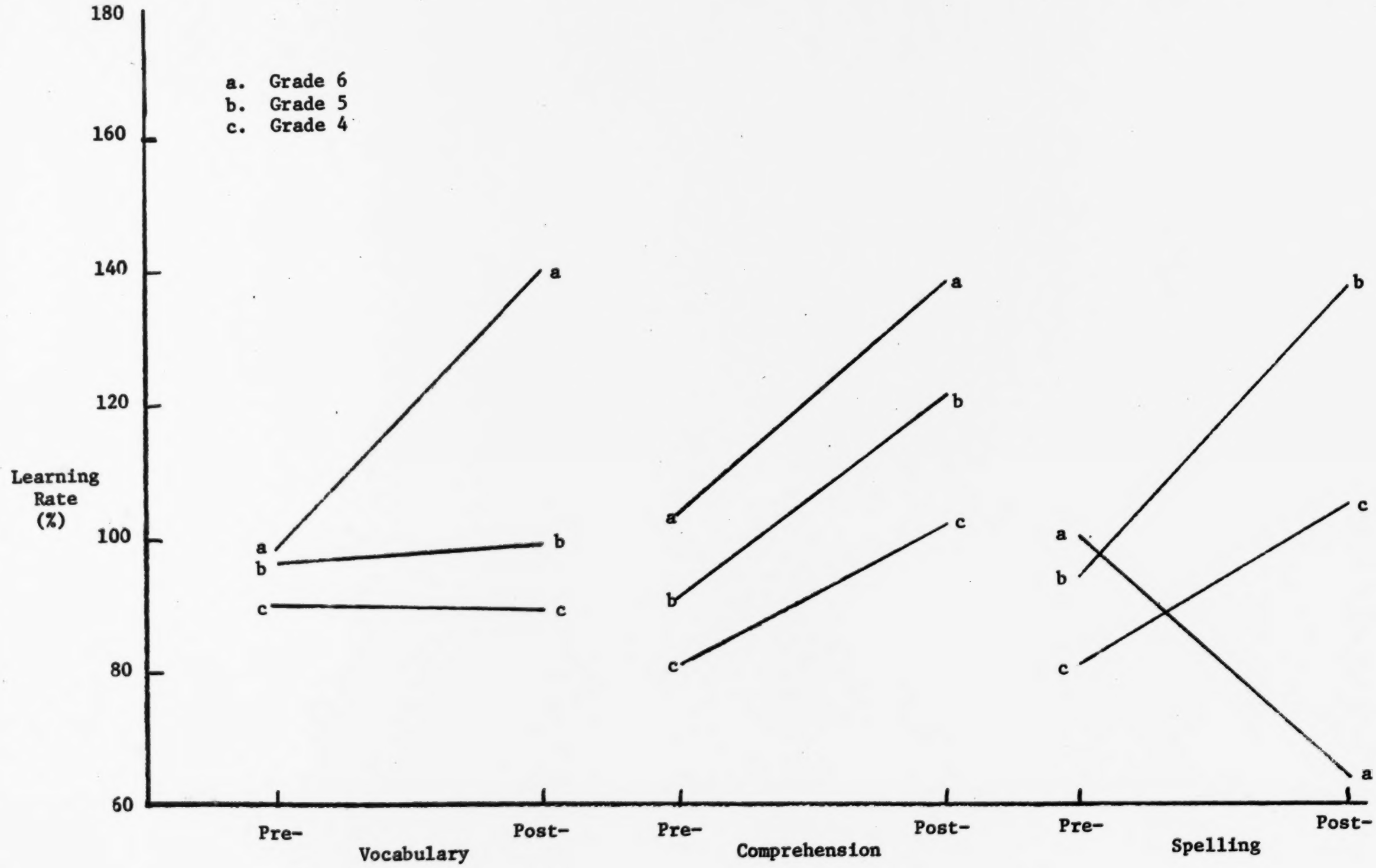


Figure 6. LEARNING RATE RESULTS FOR GRADE ANALYSIS

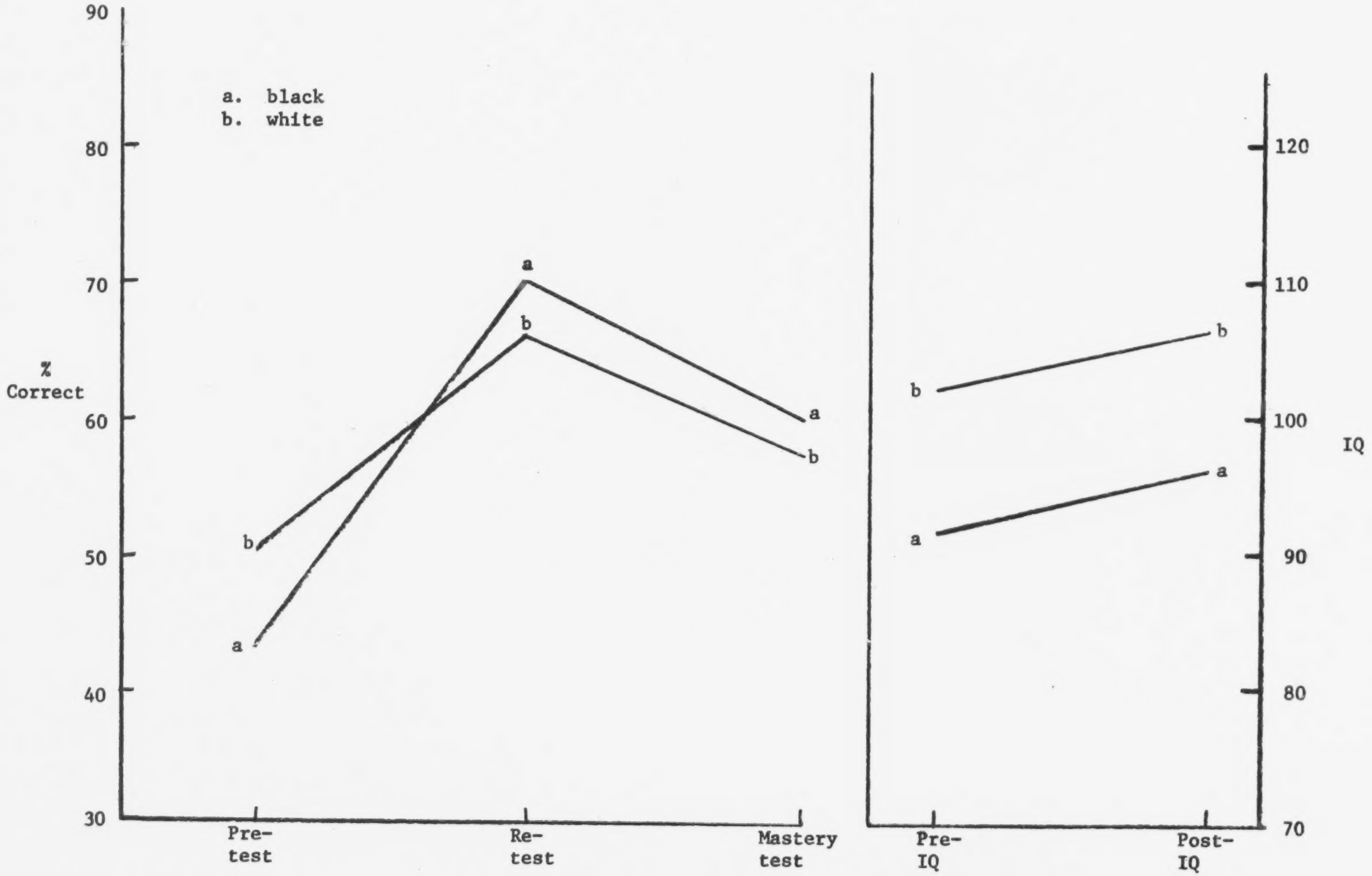


Figure 7. VOCABULARY PROJECT RESULTS AND IQ CHANGES FOR RACE ANALYSIS

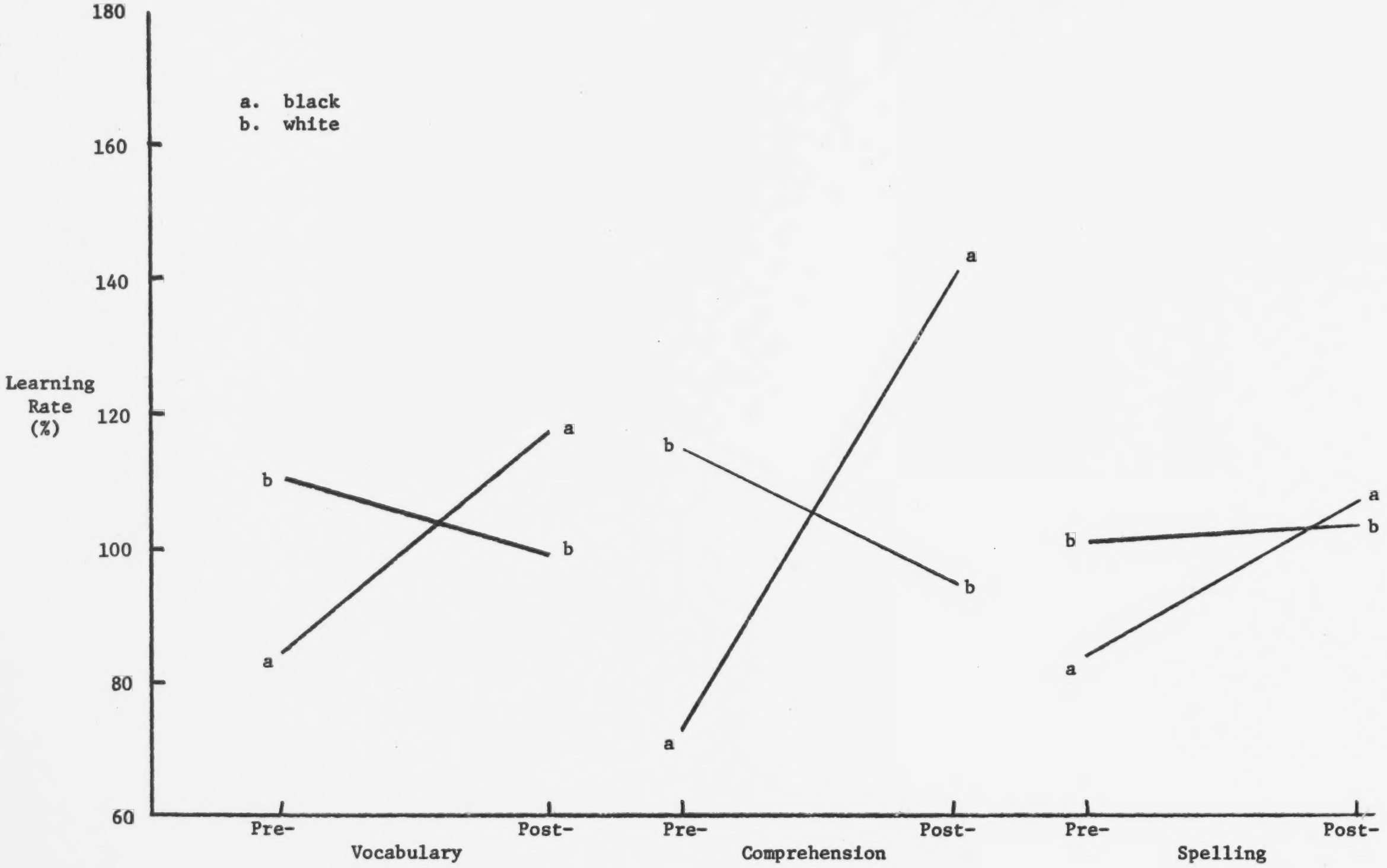


Figure 8. LEARNING RATE FOR RACE ANALYSIS

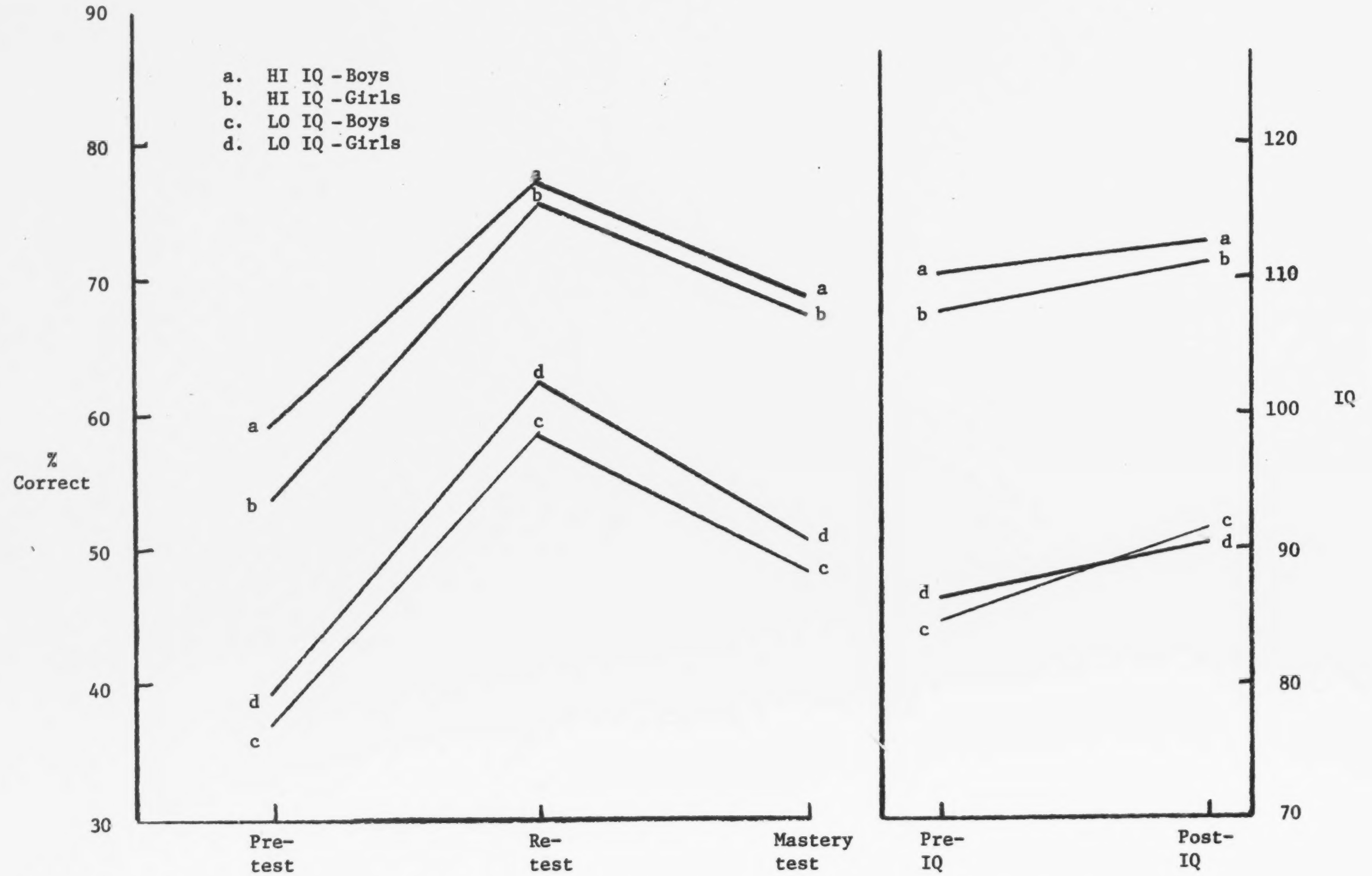


Figure 9. VOCABULARY PROJECT TEST RESULTS AND IQ CHANGES FOR IQ X SEX ANALYSIS

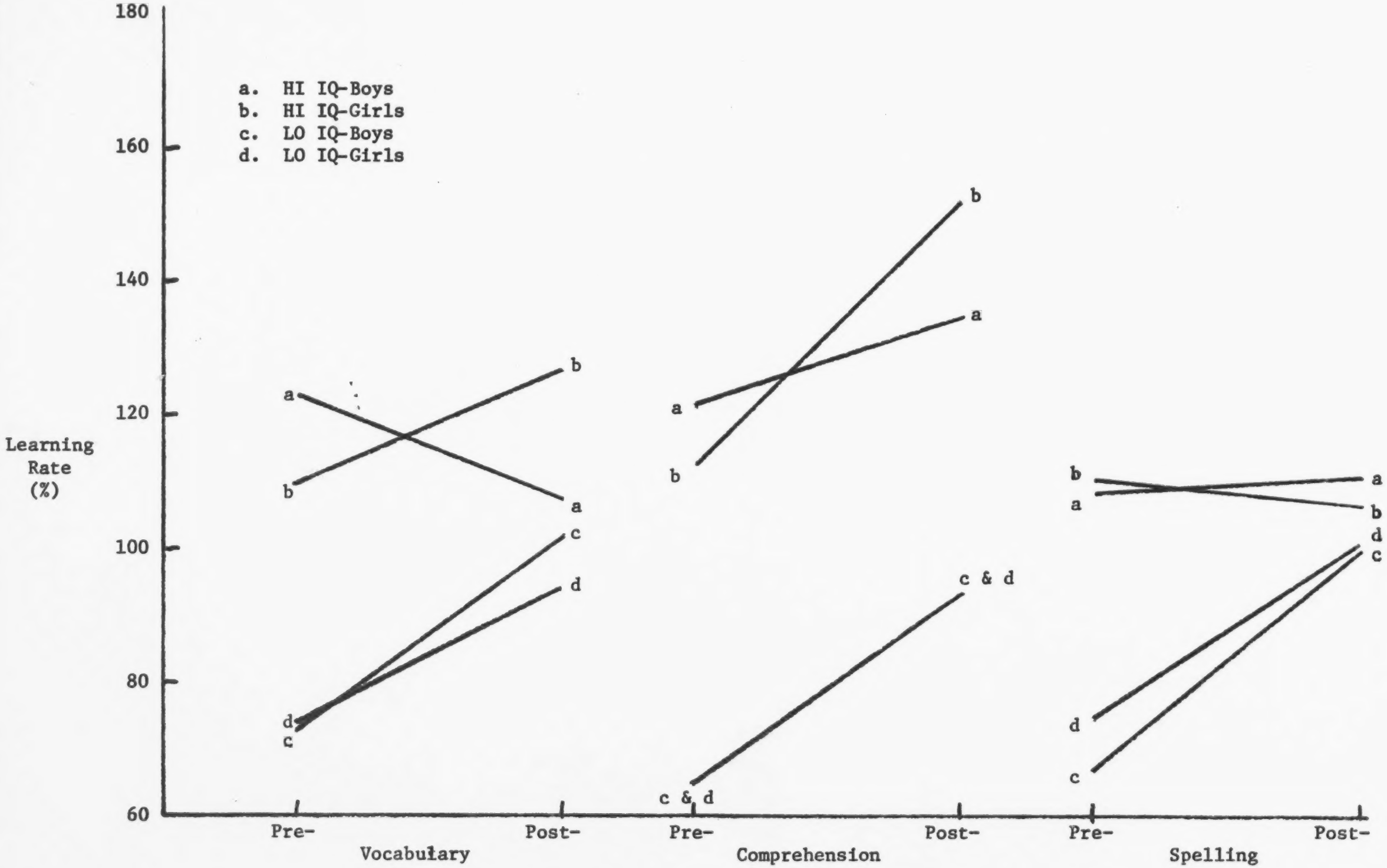


Figure 10. LEARNING RATE RESULTS FOR IQ X SEX ANALYSIS

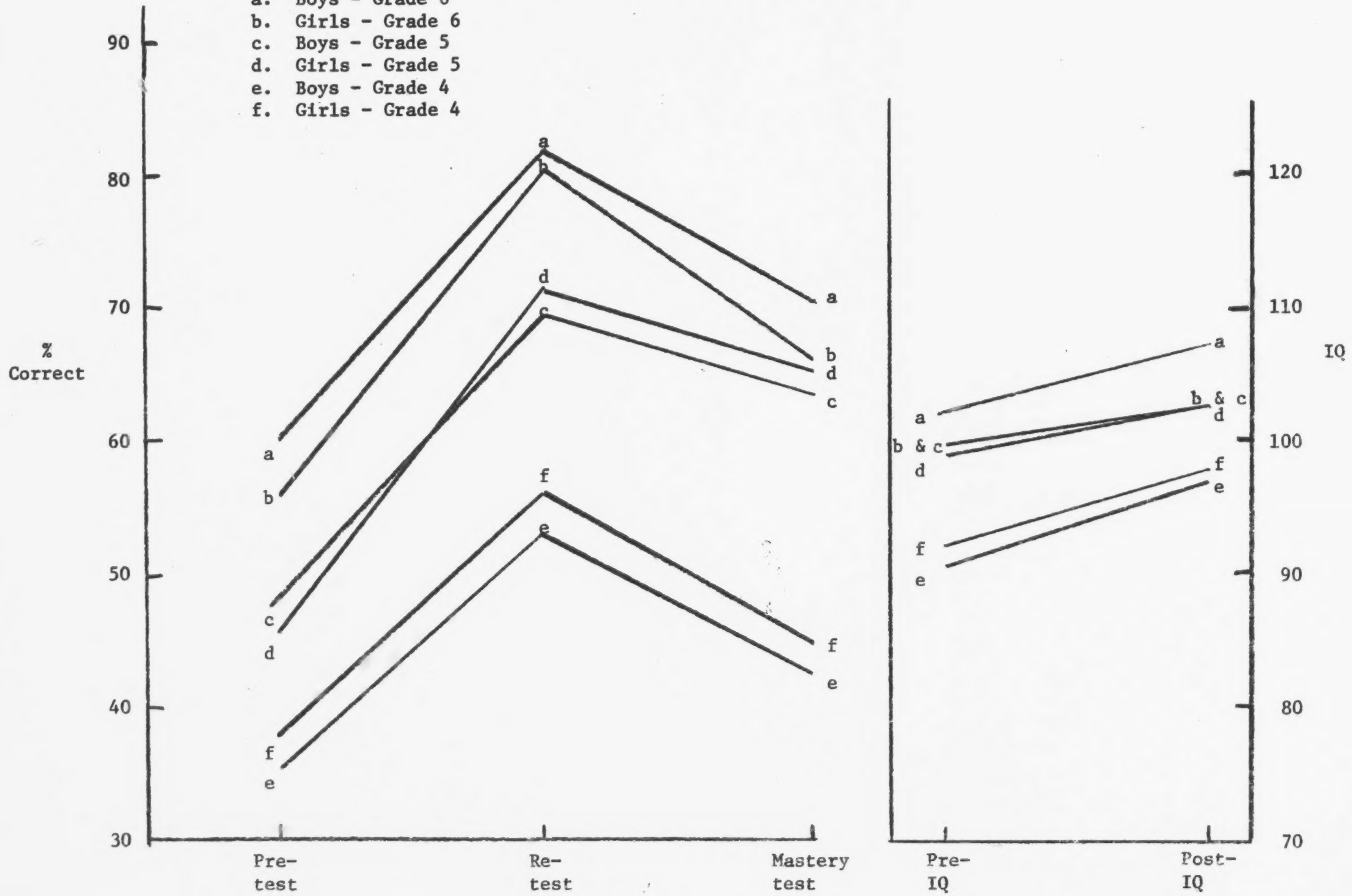


Figure 11. VOCABULARY PROJECT TEST RESULTS AND IQ CHANGES FOR SEX X GRADE ANALYSIS

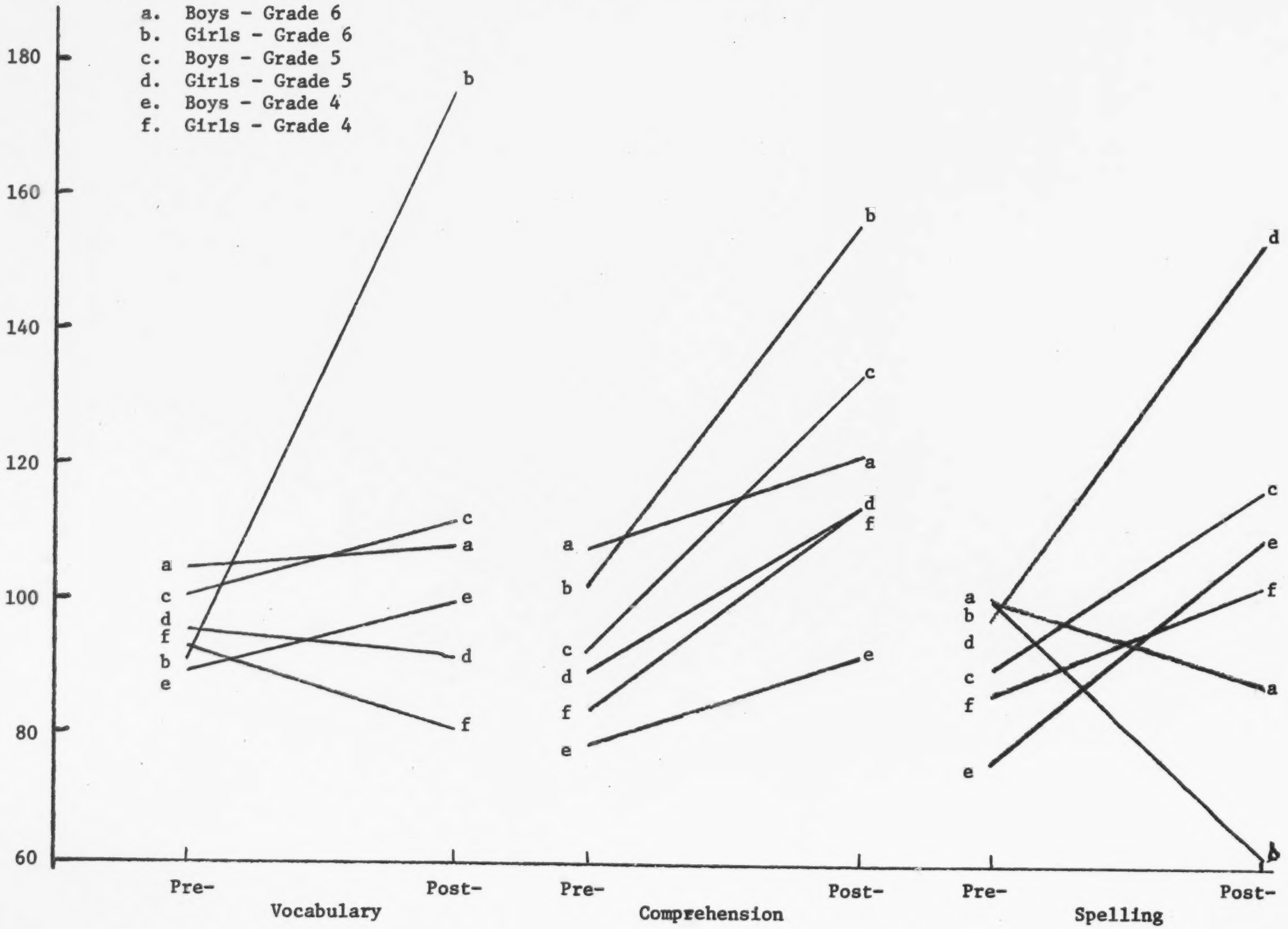


Figure 12. LEARNING RATE RESULTS FOR SEX X GRADE ANALYSIS

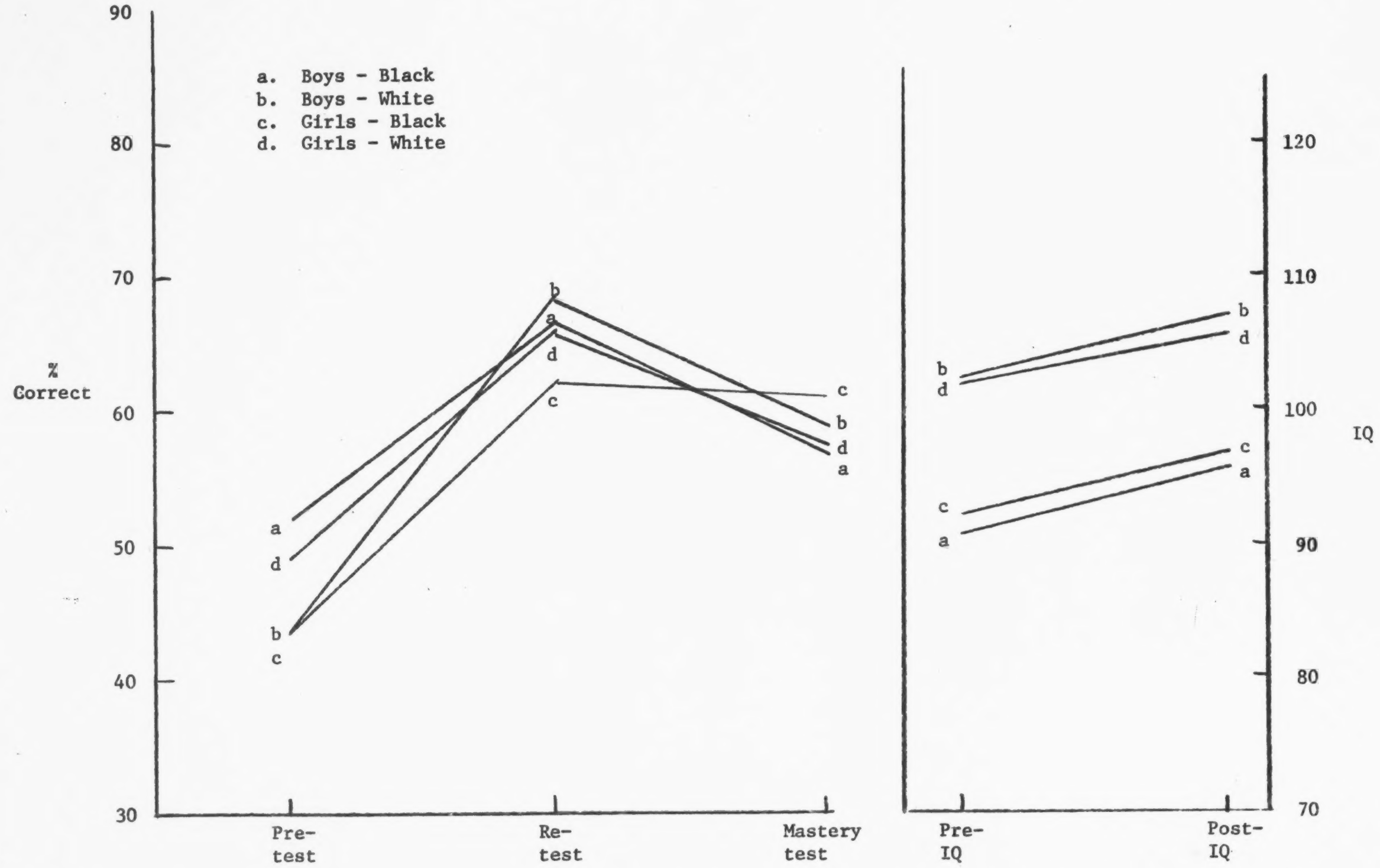


Figure 13. VOCABULARY PROJECT TEST RESULTS AND IQ CHANGES FOR SEX X RACE ANALYSIS

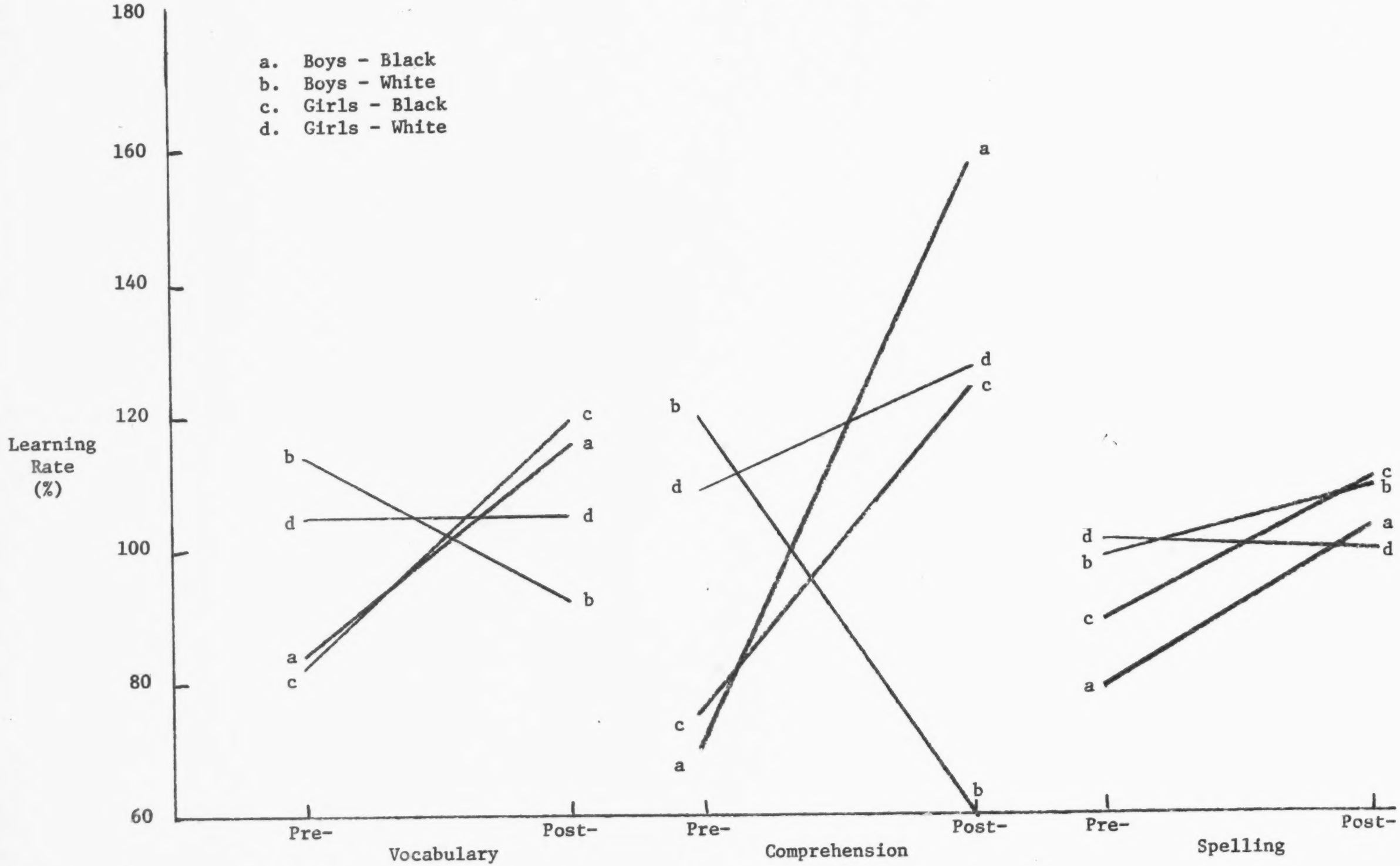


Figure 14. LEARNING RATE RESULTS FOR SEX X RACE ANALYSIS

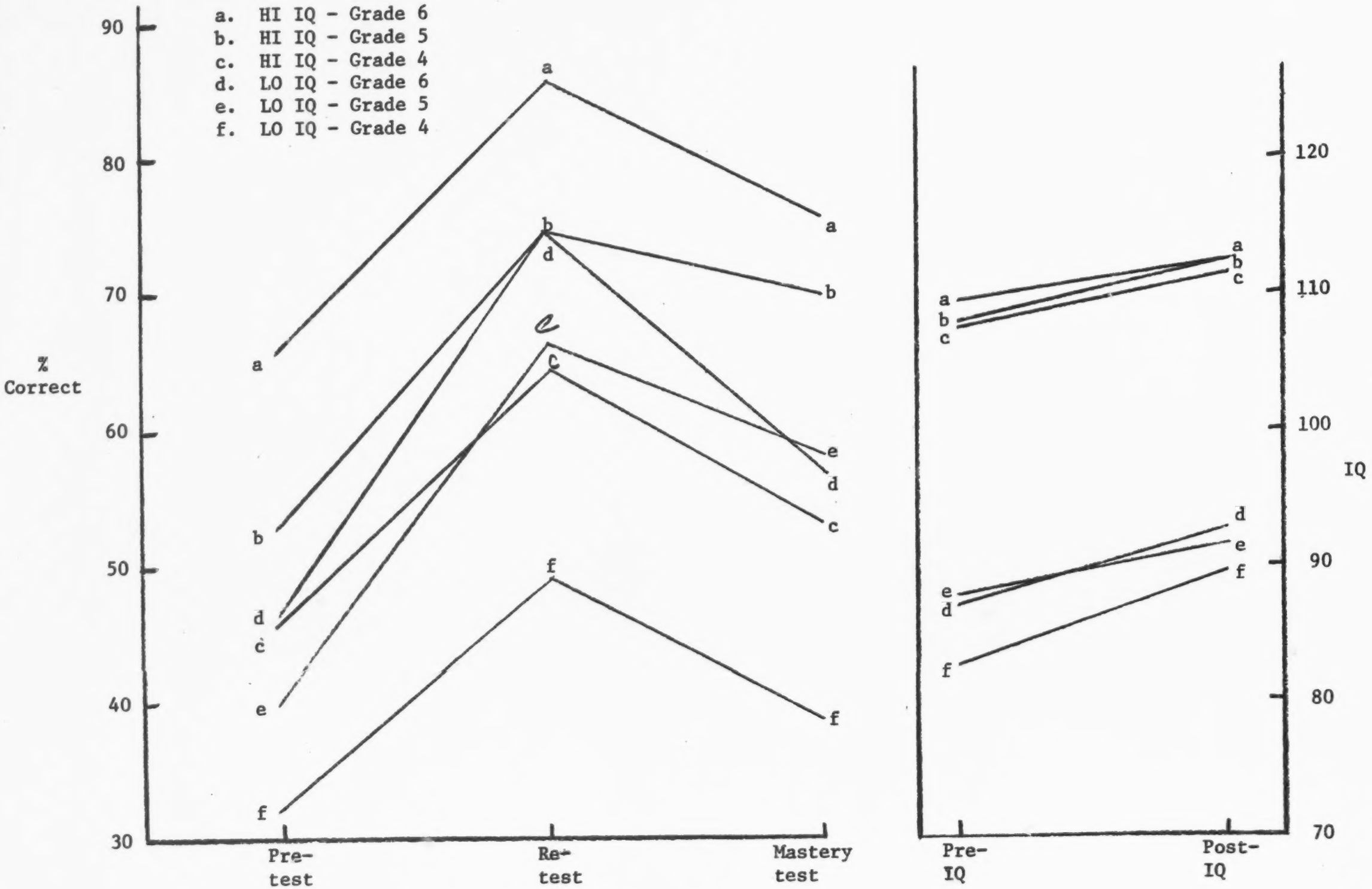


Figure 15. VOCABULARY PROJECT TEST RESULTS AND IQ CHANGES FOR IQ X GRADE ANALYSIS

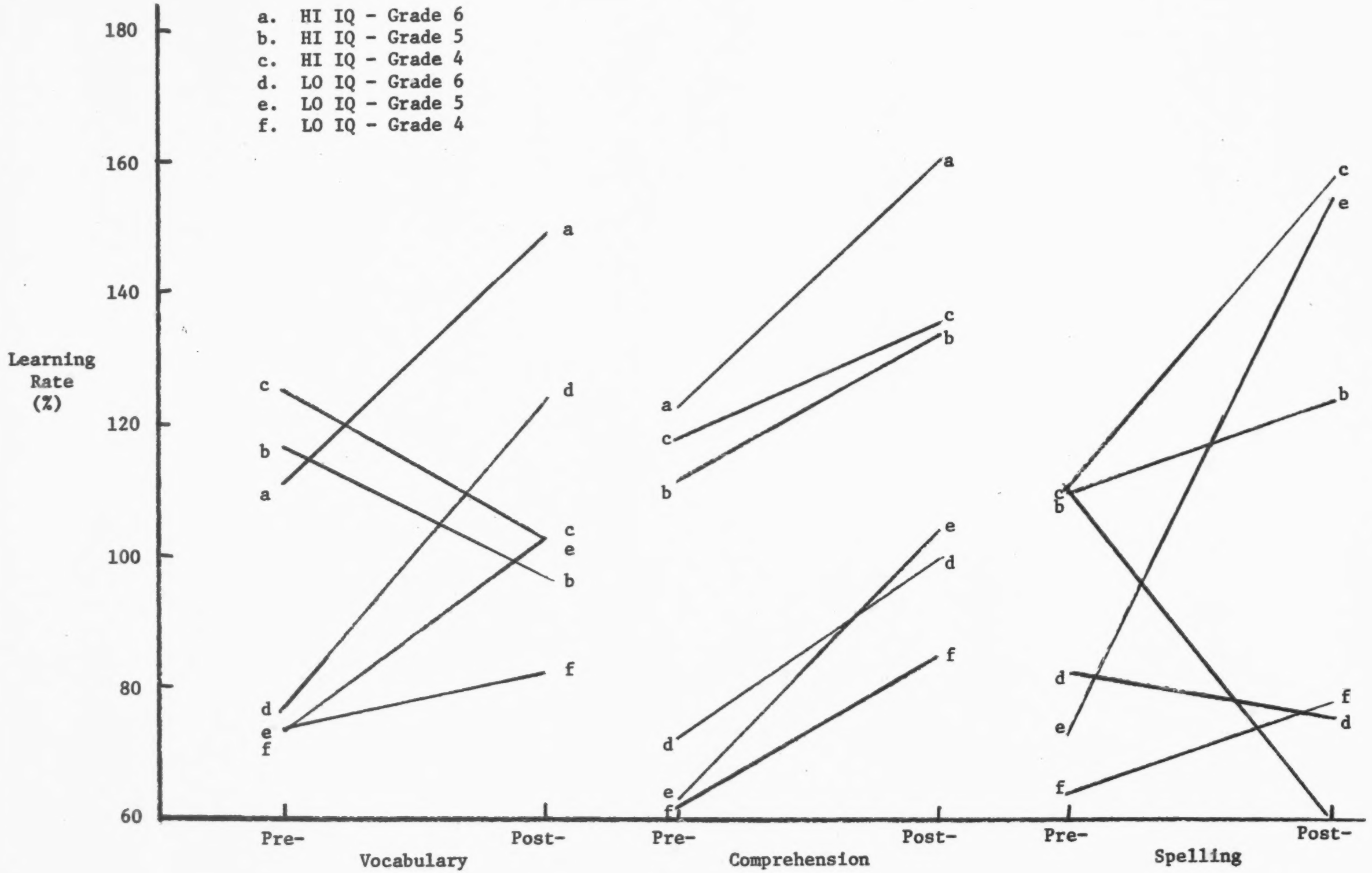


Figure 16. LEARNING RATE RESULTS FOR IQ X GRADE ANALYSIS

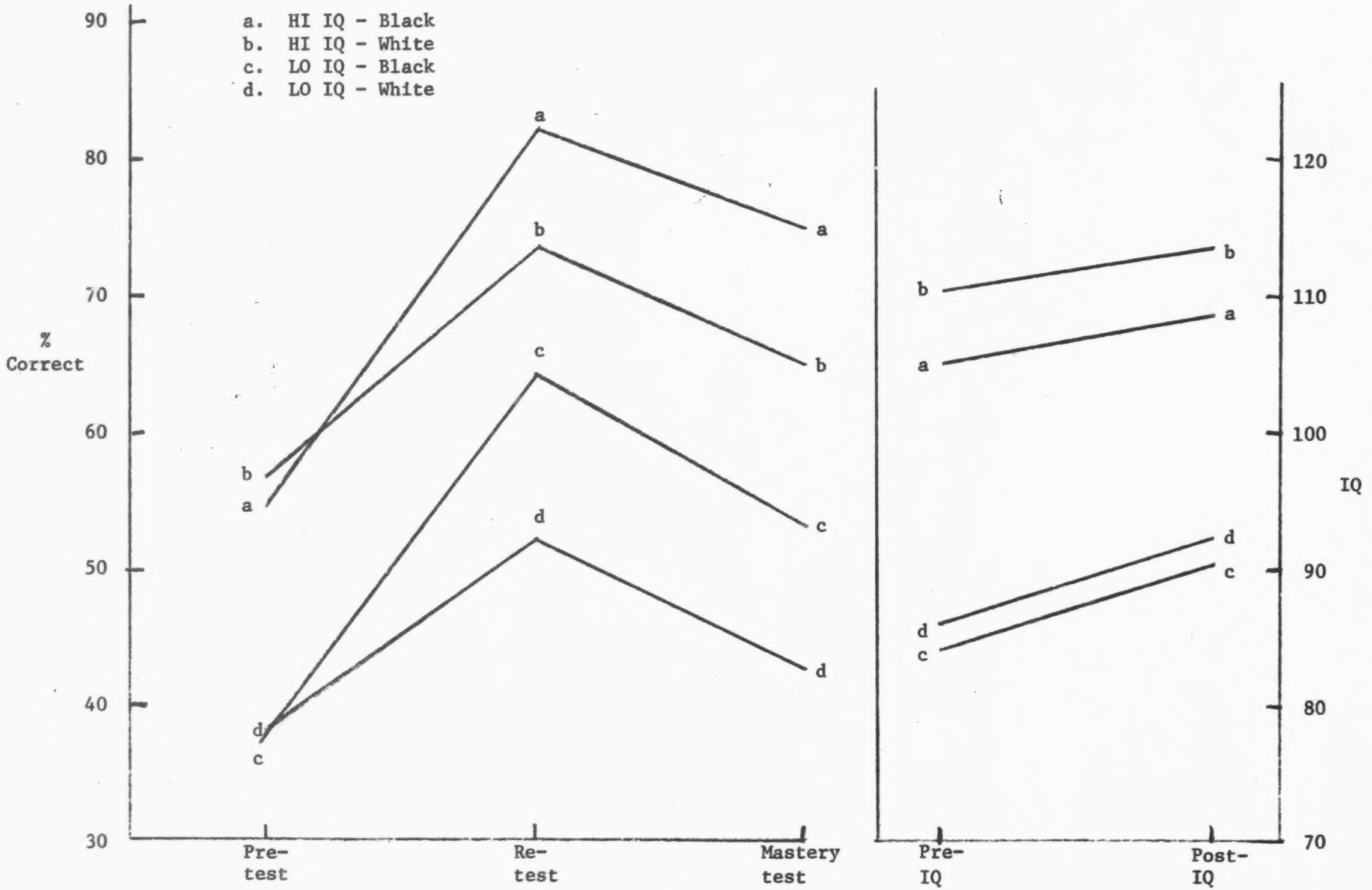


Figure 17. VOCABULARY PROJECT TEST RESULTS AND IQ CHANGES FOR IQ X RACE ANALYSIS

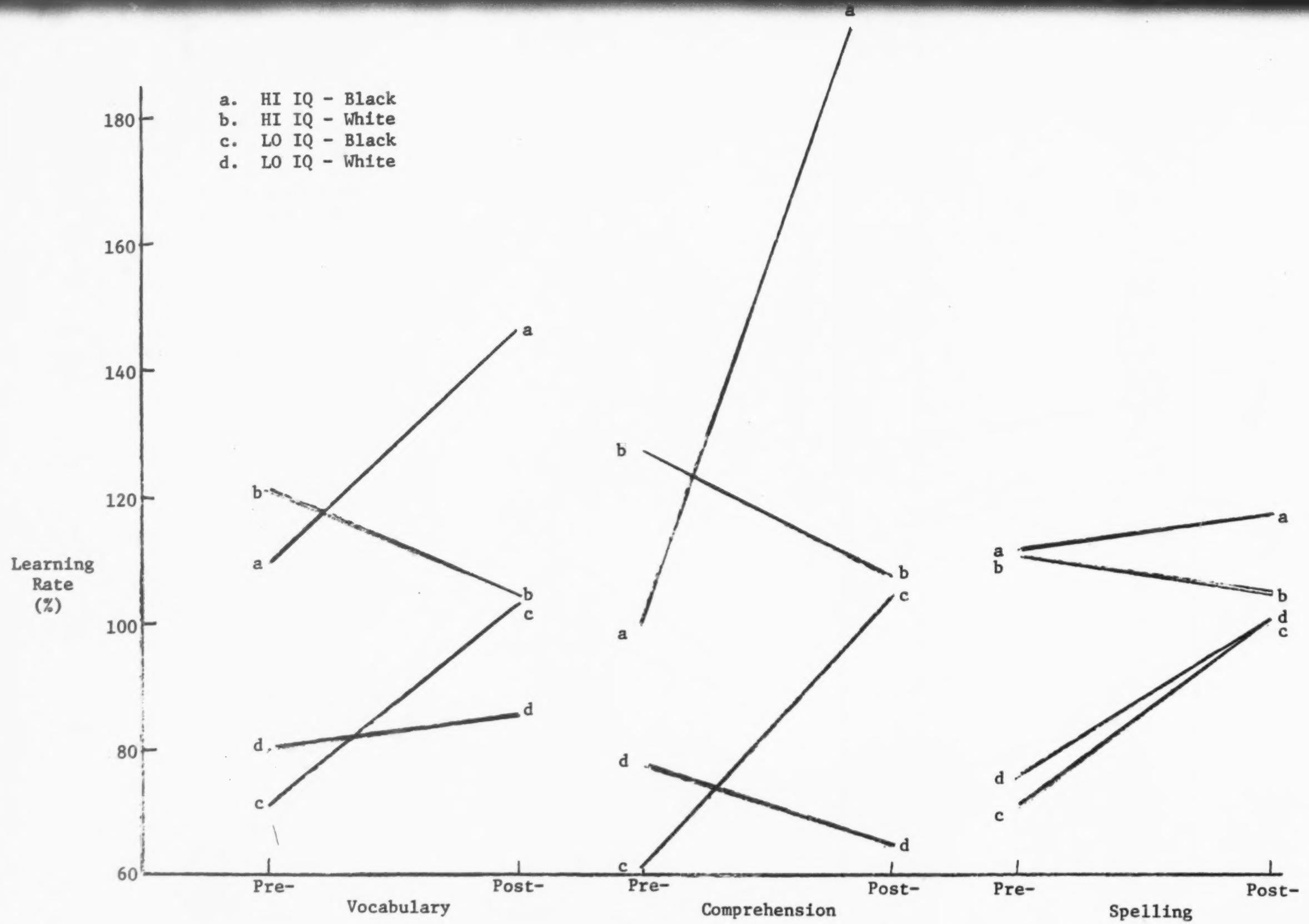


Figure 18. LEARNING RATE RESULTS FOR IQ X RACE ANALYSIS

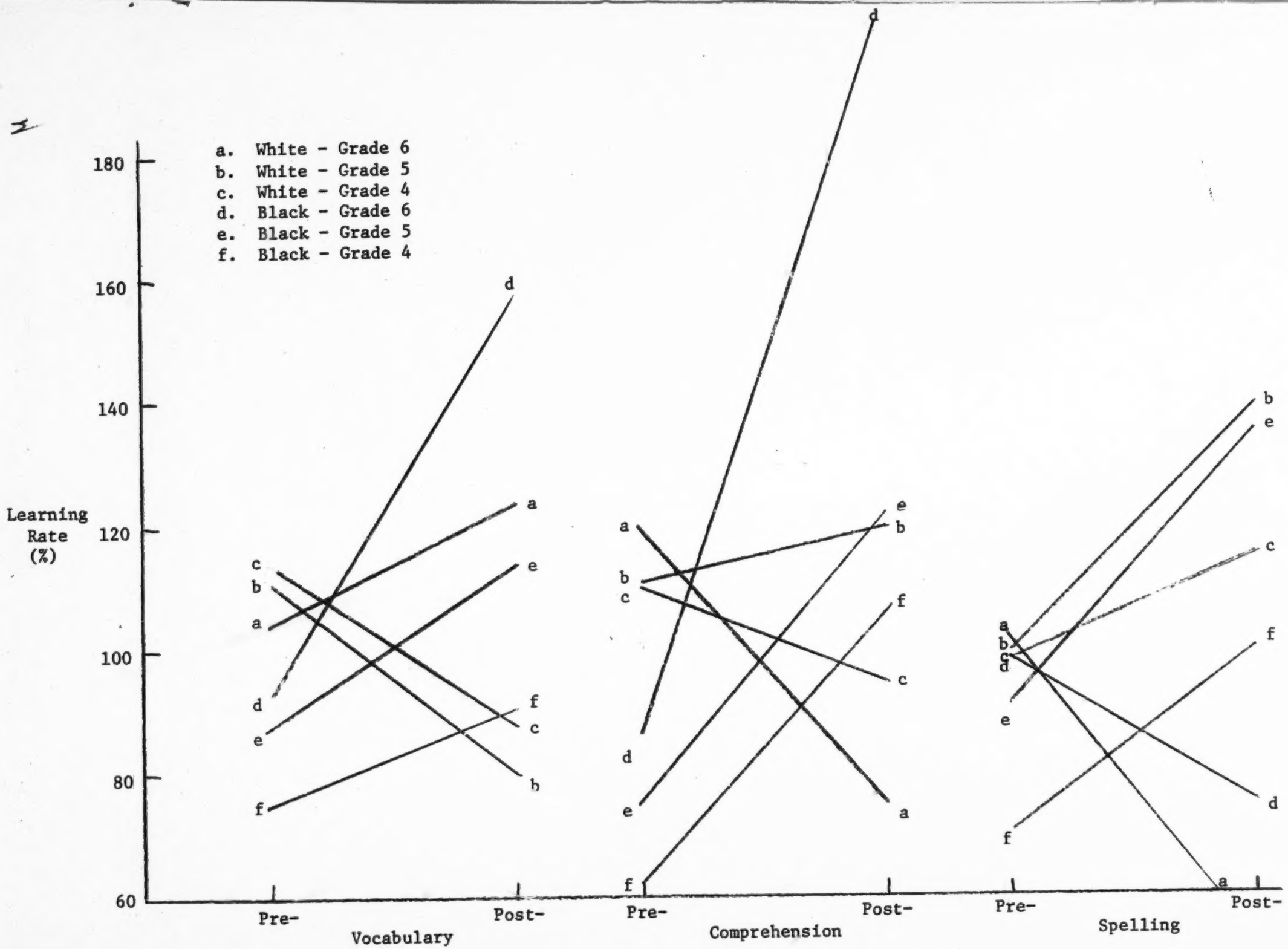


Figure 20. LEARNING RATES RESULTS FOR RACE X GRADE ANALYSIS